BLM LIBRARY
88013623

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

powder river

DRAFT ENVIRONMENTAL IMPACT STATEMENT

coal

1984

88013623

TD
195
.C5
P68
198

BLM Library
D-553A, Building 50
Denver Federal Center
P. O. Box 25047
Denver, CO 80225-0047

United States Department of the Interior
Bureau of Land Management

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
for
ROUND II COAL LEASE SALE
in the
POWDER RIVER REGION

Hillary A. Oden

WYOMING STATE DIRECTOR

January 1984

DRAFT EIS FOR 1984 COAL LEASE SALE
POWDER RIVER REGION

Lead Agency: Bureau of Land Management, U.S. Department of the Interior

Cooperating Agency: Forest Service, U.S. Department of Agriculture

Type of Action: Administrative

Abstract:

This statement assesses the environmental consequences of five alternatives for new leasing of coal. The new leasing alternatives range from leasing 9 tracts (0.997 billion tons) to leasing 22 tracts (4.515 billion tons). A sixth alternative, the "no action" alternative, also is included. The "no action" alternative includes seven coal exchanges: I-90 exchanges for Big Horn Coal, Gulf, Belco, and Kerr-McGee; an alluvial valley floor exchange for Whitney Benefits/Peter Kiewit Sons; and exchanges from Northern Cheyenne legislation for Peabody Coal Company and Consolidation Coal Company. The "no action" alternative also includes 67 preference right lease applications totaling 15 mine units and the existing mining operations listed in appendix B.

The statement assesses impacts that would result from additional federal coal leasing and development and cumulative impacts from the exchanges and preference right lease applications. The counties for which impacts are assessed are Campbell, Converse, Crook, Johnson, Natrona, Sheridan, and Weston in Wyoming and Big Horn, Powder River, and Rosebud in Montana.

Further information regarding this statement or the alternatives may be obtained from the address below. Comments, which will be accepted until April 30, 1984, should be addressed to:

Mr. Charles Wilkie, Team Leader
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

This draft environmental impact statement will be available to the EPA and the public February 29, 1984.

CONTENTS

Summary

Introduction 1
Recommendation 1
Issues 1
Alternatives 1
Major Conclusions 2
Unavoidable Commitments 3
Abbreviations 5

Chapter 1: Purpose of and Need for the Action

Coal Lease Sales 7
- Purpose 7
- Need 7
- Background 7
- Procedure 8
- Public Involvement 9

Other Types of Coal Leasing 14
- I-90 Exchanges 14
- Preference Right Lease Applications 14
- Northern Cheyenne Coal Exchanges 15

Legislation and Regulations 15
Schedule of Further Activity 16

Chapter 2: Alternatives, Including the Proposed Action

Introduction 17
The Alternatives 17
Tracts of Special Interest 17
Special Actions 22
Assumptions 22
Mitigation Requirements 23
Summary of Major Consequences 23
- Alternative 1 23
  - Soils, Vegetation, and Reclamation 23
  - Water Resources 23
  - Land Use 24
  - Air Quality 24
  - Transportation Facilities 24
  - Economic and Social Conditions 24
- Alternative 2 26
  - Soils, Vegetation, and Reclamation 26
  - Water Resources 26
  - Land Use 27
  - Air Quality 27
  - Transportation Facilities 27
  - Economic and Social Conditions 27
- Alternative 3 28
  - Soils, Vegetation, and Reclamation 28
  - Water Resources 28
  - Land Use 28
  - Air Quality 28
  - Transportation Facilities 28
  - Economic and Social Conditions 28
- Alternative 4 29
  - Soils, Vegetation, and Reclamation 29
  - Water Resources 29

Land Use 29
Air Quality 29
Transportation Facilities 29
Economic and Social Conditions 29
Alternative 5 29
Soils, Vegetation, and Reclamation 29
Water Resources 29
Land Use 30
Air Quality 30
Transportation Facilities 30
Economic and Social Conditions 30
Alternative 6 30
Soils, Vegetation, and Reclamation 30
Water Resources 30
Land Use 30
Air Quality 31
Transportation Facilities 31
Economic and Social Conditions 31

Chapter 3: The Affected Environment

Introduction 33
Geology and Minerals 33
Soils and Reclamation 33
Vegetation 34
Water Resources 35
Land Use 37
Wildlife 37
Wyoming 37
Montana 41
Cultural Resources 42
Visual Resources 43
Noise 44
Air Quality 44
Transportation Facilities 47
Employment and Salaries and Wages 47
Population and Housing 50
Revenues and Expenditures 53
Community Services 63
Sociology 63
Wyoming 63
Campbell County 63
Sheridan County 82
Montana 83
Rosebud County 83
Powder River County 84
Big Horn County 85
The Northern Cheyenne 85
The Crow 87
Capacity of Communities to Absorb Change 87

Chapter 4: Environmental Consequences

Introduction 91
Geology and Minerals 91
Soils, Vegetation, and Reclamation 91
Water Resources 93
Land Use 96
Wildlife 97
Alternative 2 97
Alternative 3 98
Alternative 4 98

Alternative 5 100
Alternative 6 101
All Alternatives 101
Cultural Resources 102
Visual Resources 103
Noise 103
Air Quality 103
Introduction 103
Possible Effects in This Region 104
    Visibility Impairment 104
    Total Suspended Particulates 105
    Sulfur Dioxide and Nitrogen Dioxide 108
    Unavoidable Adverse Impacts 108
    Short-term and Long-term Effects 108
    Irreversible and Irretrievable Effects 108
Transportation Facilities 108
Railroads 108
Highways 111
Employment and Salaries and Wages 111
Population and Housing 115
Revenues and Expenditures 122
Community Services 131
Sociology 131
Alternative 2 131
Alternative 3 131
Alternative 4 139
Alternative 5 140
Alternative 6 141

Chapter 5: Proposed Mitigation of Social and Economic Issues

Introduction 145
Regulatory Environments in Montana and Wyoming 145
Local Siting Authority in Montana 145
Montana Energy Impact Funding and Indian Tribes 146
The Mineral Leasing Act and Off-site Mitigation 146
Federal Mine Plan Review and Off-site Mitigation 147
Proposals Received 147
Background 147
Northern Cheyenne Proposals 147
    Employment Preference 147
    Contracting Preference 148
    Law and Order and Traffic 149
    Environmental Protection 150
    Impact Assistance 151
Northern Plains Resource Council Proposal 153

Chapter 6: Consultation and Coordination

Preparers 155
Cooperating Agencies 155
Consultation 156
Distribution 156

Appendixes

A: Net Energy Analysis 157

B: Energy-Related Industrial Development in the Powder River Region 158

C: Mitigation Requirements **161**
Introduction 161
Measures Applied to All Tracts 161
Measures for Wyoming Tracts 163
Measures for Montana Tracts 170
D: Visual Management System **173**
Forest Service Visual Management System 173
BLM Visual Resource Management 173
E: Air Quality **175**
Air Quality Laws 175
Methodology Used in Analysis 175
Figures 1 through 16 177
F: Northern Cheyenne Indian Tribe's Proposed Stipulation **193**

References **201**

TABLES

Chapter 1

1-1 Coal Data by Tract 10
1-2 Tract Ranking Factors 11
1-3 Ranking of Selected Tracts 12
1-4 Alternatives for Proposed 1984 Coal Lease Sale 13

Chapter 2

2-1 Comparison of Alternatives—Cumulative Environmental Impacts 18
2-2 Incremental Population Changes, Each Alternative 25
2-3 Acreage of Land Disturbed by Coal Mining, Each Alternative 27

Chapter 3

3-A Acreage of Vegetative Types in Coal Lease Areas by Alternative 35
3-1 Antelope and Deer Harvest in Wyoming 38
3-2 Acreage Disturbed by Coal Mining in Hunt Areas 38
3-3 Ambient Air Quality Standards 45
3-4 Maximum Allowable Increases for Prevention of Significant Deterioration 45
3-5 Ambient Background Concentrations of Pollutants 45
3-6 Trends for Employment and Salaries and Wages—Eastern Powder River Region 46
3-7 Trends for Employment and Salaries and Wages—Sheridan County 51
3-8 Trends for Employment and Salaries and Wages—Northern Powder River Region 52
3-9 Labor Force, Employment, and Unemployment—Crow and Northern Cheyenne 53
3-10 Population and Housing—Eastern and Western Powder River Region 57
3-11 Population and Housing—Sheridan County 58
3-12 Population and Housing—Northern Powder River Region 59
3-13 Population and Housing—Crow and Northern Cheyenne 60
3-14 Local Expenditure Levels and Projections—Eastern and Western Powder River Region 61
3-15 Local Expenditure Levels and Projections—Northern Powder River Region 62
3-16 Local Expenditure Levels and Projections—Crow and Northern Cheyenne 62
3-17 Community Services, 1979-1980, Eastern and Western Powder River Region 64
3-18 Estimated 1985 Requirements for Community Services, Eastern and Western Powder River Region 65
3-19 Estimated 1987 Requirements for Community Services, Eastern and Western Powder River Region 66
3-20 Estimated 1988 Requirements for Community Services, Eastern and Powder River Region 67
3-21 Estimated 1990 Requirements for Community Services, Eastern and Western Powder River Region 68
3-22 Estimated 1995 Requirements for Community Services, Eastern and Western Powder River Region 69
3-23 Community Services, 1979-1980, Northern Powder River Region 70
3-24 Estimated 1985 Requirements for Community Services, Northern Powder River Region 71
3-25 Estimated 1987 Requirements for Community Services, Northern Powder River Region 72
3-26 Estimated 1988 Requirements for Community Services, Northern Powder River Region 73
3-27 Estimated 1990 Requirements for Community Services, Northern Powder River Region 74
3-28 Estimated 1995 Requirements for Community Services, Northern Powder River Region 75
3-29 Community Services, 1979-1980, Crow and Northern Cheyenne 76
3-30 Estimated 1985 Requirements for Community Services, Crow and Northern Cheyenne 77
3-31 Estimated 1987 Requirements for Community Services, Crow and Northern Cheyenne 78

3-32 Estimated 1988 Requirements for Community Services, Crow and Northern Cheyenne 79
3-33 Estimated 1990 Requirements for Community Services, Crow and Northern Cheyenne 80
3-34 Estimated 1995 Requirements for Community Services, Crow and Northern Cheyenne 81

Chapter 4

4-1 Depth of Soil on Montana Tracts after Replacement 93
4-2 Reductions in Stream Discharge Due to Mining 95
4-3 Increase in Total Dissolved Solids Due to Mining 96
4-4 Total Acreage Consumed by Coal Mining and Related Land Uses 97
4-5 Railroad Noise 104
4-6 Estimated Emission of TSP by 1995 106
4-7 Estimated Emission of Pollutants from Power Plants by 1995 106
4-8 Maximum Concentrations of TSP by 1995 versus Ambient Air Quality Standards 106
4-9 Sources of Offsite Violations of State 24-hour Air Quality Standards by 1995 107
4-10 Trains per Day and At-Grade Crossing Effects 110
4-11 Employment and Salaries and Wages in 1990 under Alternatives, Eastern and Western Powder River Region 112
4-12 Employment and Salaries and Wages in 1990 under Alternatives, Sheridan County 114
4-13 Employment and Salaries and Wages in 1990 under Alternatives, Northern Powder River Region 116
4-14 1990 Population and Housing under Alternatives, Eastern and Western Powder River Region 117
4-15 1990 Population and Housing under Alternatives, Sheridan County 118
4-16 1990 Population and Housing under Alternatives, Northern Powder River Region 120
4-17A 1990 Population and Housing under Alternatives, Crow and Northern Cheyenne Reservations 121
4-17B Distribution of Primary Employment with Indian Participation by Place of Residence (Judgmental Weighting) 123
4-17C Alternate Population Distribution Based on Indian Participation in Primary Employment Opportunities 124
4-18 Revenues Compared to Expenditures under Alternatives, Eastern and Western Powder River Region 126
4-19 Revenues Compared to Expenditures under Alternatives, Northern Powder River Region 129
4-20 Revenues Compared to Expenditures under Alternatives, Crow and Northern Cheyenne Reservations 130
4-21 School Enrollment and Hospital Beds Required in 1990 under Alternatives 132
4-22 Law Officers Required in 1990 under Alternatives 133
4-23 Firefighters Required in 1990 under Alternatives 134
4-24 Water Capacity Required in 1990 under Alternatives 136
4-25 Sewage Capacity Required in 1990 under Alternatives 137

FIGURES

2-1 Powder River Regional Coal—Annual Production Capacity to 1995 21
3-1 Population Trends, Eastern Powder River Region 54
3-2 Population Trends, Western Powder River Region 55
3-3 Population Trends, Northern Powder River Region 56
4-1 Projected Unit Trains per Day and 1995 Coal Production Potential 109

SUMMARY

INTRODUCTION

This draft environmental impact statement analyzes the environmental impacts of the proposed competitive leasing of 22 federal surface minable coal lease tracts in the Powder River Coal Region. This is the second round of federal coal leasing in this region.

The Department of the Interior, through the Bureau of Land Management, periodically conducts competitive coal lease sales to ensure that adequate coal supplies are available to meet national long-term energy requirements and that adequate reserves are available to continue existing production. The Secretary of the Interior established a leasing level range of 1.2 to 4.85 billion tons of recoverable coal for this round of leasing in the Powder River Coal Region on April 29, 1983.

The Powder River Coal Region includes parts or all of Natrona, Converse, Johnson, Campbell, Sheridan, Crook, and Weston counties in Wyoming and Rosebud, Big Horn, and Powder River counties in Montana. Proposed federal coal leasing would occur primarily in Campbell County, Wyoming, and in Rosebud and Big Horn counties in Montana.

RECOMMENDATION

The Bureau of Land Management recommends that Alternative 5 be selected as the preferred alternative. Analysis of the 17 tracts in this alternative indicates that 8 of the 17 would be maintenance tracts for the perpetuation of existing coal mining operations. Total recoverable tonnage from this alternative equals about 2.6 billion tons. That amount is well within the recommended leasing level range of 1.2 to 4.85 billion tons. With this alternative, impacts such as high population increase, water consumption, and air pollution associated with the proposed coal-fired generator in the Mud Springs tract would be avoided.

ISSUES

Issues and alternatives were discussed and formulated by the Powder River Regional Coal Team in June 1983. No new alternatives or issues within the scope of this environmental impact statement (EIS) were indentified during the public scoping process, but existing issues were expanded, with concerns about specific areas or resource conflicts being raised. Major areas of concern or controversy raised during the public scoping period were reclamation and revegetation, air quality, water quality and quantity, population increases, socioeconomic impacts to Indian reservations, land use, and impacts to ranch operations, economics, and social values.

ALTERNATIVES

Six alternatives are addressed in this EIS: the "no action" alternative and five alternatives with different leasing levels in which from 9 to 22 tracts would be offered in a proposed 1984 lease sale.

The leasing alternatives include various mitigation requirements, which are considered parts of the proposed federal actions under all alternatives.

The "no action" alternative would not offer federal coal for competitive leasing. Both coal-related activities and activities not related to coal would continue to occur within the region without new federal leasing. These activities include natural population growth, maintenance of existing industrial operations, and development of new operations where resources were previously committed. Taken together, these activities constitute the "baseline," which is a projection of overall development trends until the year 2000 without additional federal coal leasing.

Current energy-related industrial developments included in the baseline are listed in appendix B.

Alternative 2 proposes the leasing of 9 tracts, 3 in Wyoming and 6 maintenance tracts in Montana. A total of 997 million tons of recoverable coal reserves would be offered for sale.

Under Alternative 3, a total of 11 tracts would be offered for leasing—3 in Wyoming and 8 in Montana. The 11 tracts contain 1.384 billion tons of recoverable coal reserves. This alternative proposes leasing the Wyoming tracts included in Alternative 2, the Montana maintenance tracts, and 2 competitive tracts in Montana.

Alternative 4 proposes leasing 15 tracts, 6 in Wyoming and 9 in Montana. A total of 2.297 billion tons of recoverable coal reserves would be offered for sale.

Alternative 5 would offer 17 tracts for competitive leasing, 8 in Wyoming and 9 in Montana. The 17 tracts contain a total of 2.605 billion tons of recoverable coal. The same number of Montana tracts would be offered as in Alternative 4; however, the Mud Springs tract in Alternative 4 was replaced in Alternative 5 by the Hanging Woman tract.

Alternative 6, the maximum alternative, proposes leasing 22 tracts, 11 in Wyoming and 11 in Montana. A total of 4.515 billion tons of recoverable coal would be offered for sale under this alternative.

MAJOR CONCLUSIONS

Overall Impacts

Analysis of the region indicates that new federal coal leasing would cause no significant impacts to the following resources under any alternative: climate, physiographic provinces, geologic structure, floodplains, threatened or endangered plant species, prime farmland, wilderness or wilderness study areas, recreation, areas of critical environmental concern, or wild and scenic rivers.

Resources that would incur one or more significant impacts are air quality; geology; topography, and minerals, water; vegetation; wildlife; visual; land use; economics; social values; and transportation facilities.

Impacts in Wyoming would be centered in the urbanized communities of Sheridan in Sheridan County and Gillette in Campbell County. Sheridan has been experiencing energy-related impacts due to coal mine development principally in Montana for the past 10 to 15 years. Similar impacts in Gillette have stemmed from coal and from oil and gas exploration and production in Campbell County and surrounding areas.

Impacts in Montana would be continued in the communities of Colstrip and Ashland. Additional impacts would occur on either side of the rural Decker area. Unlike Wyoming communities, the Montana communities, with the exception of Colstrip, have experienced very little growth over the past decade. Therefore, social and economic impacts caused by increased population would affect this subregion heavily. The Northern Cheyenne and Crow Indian reservations also could experience impacts.

All the alternatives, including the "no action" alternative, would further diversify the economic base within the region. The trend is well established in Wyoming but would create a shift in economic base in Montana, where agriculture has contributed a significant part of the economic base.

Coal leasing in Sheridan County would help relieve the impact to Sheridan caused by miners working in Montana and living in Sheridan. Development of new coal mines in Sheridan County would provide a source of revenue to offset coal-related impacts from out-of-state mining.

Geology and Other Minerals

Coal, oil and gas, and uranium exist in economic quantities within the region. Uranium activities have declined since 1980 and have presented very few conflicts to coal development. Coal production generally does not interfere with extraction of oil and gas. However, as exploration and development of the two resources expand, individual conflicts do occur. These conflicts are lessened by thorough land use planning constraints that minimize chances for the conflict to occur. The BLM's strategy has been not to develop regulations on this issue but to maintain sufficient flexibility in administration to allow industry representatives to resolve the conflicts themselves.

Water Resources

The impacts on water resources resulting from new federal leasing would be very small regionally. The loss of shallow aquifers would extend over more than 400,000 acres by 1990 under Alternative 5. Water from shallow aquifers generally is of poor quality, with dissolved solids ranging from 3,000 to 5,000 milligrams per liter, although water more suitable for human use is available. Increased costs for new well construction and greater pumping lifts are associated with the loss of shallow aquifers.

Air Quality

Air pollution from mining and indirect development would be local and would not significantly affect air quality except in the vicinity of coal lease tracts. No federal air quality standards would be violated under any of the alternatives. State standards might be violated or marginally violated on or near the Thunder Basin National Grassland in Wyoming and in the Decker area of Montana. Significant impact to the Class I air quality area on the Northern Cheyenne Indian Reservation has not been forecast.

Soils, Vegetation, and Reclamation

Soils in the area are often shallow, although slopes are generally gradual on a rolling type terrain. Reclamation potential is good, and reclamation would be successful, although it might require intense and costly management on particular areas.

Wildlife

Leasing and development of federal coal would create major impacts on local populations of wildlife, but minor effects on regional populations. Antelope would be affected most heavily in the area around Gillette, Wyoming, where existing mining operations are restricting animal movement and disturbing habitat. Impacts to mule deer would not be significant regionally. Populations of sharp-tailed grouse and sage grouse would be affected locally.

Cultural Resources

Federal and state regulations protect cultural resources. Historic and architectural resources on private land might not be protected unless steps are taken by local governments or private citizens.

Land Use

Lands within this region are administered and controlled by a variety of governmental jurisidctions, each of which exercises a different level of land use planning, development, and control of the use of resources. About 85% of the region's ownership is "split estate"; that is, private surface ownership with federally controlled minerals.

Land use patterns are expected to shift from agriculture toward mining and urbanization, without new federal coal leasing, and implementation of the preferred allternative would influence this very little. Thirty-seven landowners not related to energy who operate within the boundaries of tracts would be affected. Documented analysis (Moore 1983) suggests that land values of farms and ranches have been enhanced by coal mines in the vicinity.

Transportation Facilities

Wyoming has adequate highway capacity to handle the increas in traffic volume that would result from the alternatives. Required maintenance would be expected to fall behind because of increased use by maximum weight vehicles.

Montana's highway system is adequate in the Colstrip area but would require major upgrading in the Ashland and Decker areas. Highways of major concern include U.S. Highway 212 from Crow Agency to Ashland, and Montana secondary road 314 from U.S. 212 to Decker.

Railroad traffic would increase by 50 unit trains per day on the main line leaving the region. This traffic would be divided among the three rail lines. Forty-five miles of new rail spur line would be constructed.

Sociology and Economics

Increases in population are expected with or without new federal coal leasing. The fiscal impact to communities in Wyoming would be be significant but could be beneficial in Sheridan's case. Impacts to Montana communities would be significant, and increases in Northern Cheyenne and Crow Indian reservation populations would be expected. Most of these impacts could be mitigated, but only through strong committment and assistance from both federal and state governments.

UNAVOIDABLE COMMITMENTS

Coal included in Alternatives 2 through 6 (up to 4.5 billion tons) would be consumed if developed; therefore, it would not be available for later use.

Existing soil profiles and natural plant communities would be destroyed on between 20,000 and more than 100,000 acres, depending on which leasing alternative was selected. Mining would impair or destroy 275 to 425 wells and 25 to 49 springs, and shallow aquifers would be impaired at the magnitude of 20,000 to 100,000 acres, depending on the alternative selected.

Construction of 5 to 65 miles of new rail spur would be required under the leasing alternatives. Mining under the leasing alternatives would destroy 20,000 to 100,000 acres of wildlife habitat in the short term; wildlife habitat diversity would be lost at the same rate for the short term; and loss of topographic divesity would cause irreversible loss of cover for wildlife.

If one of the leasing alternatives was selected, mining would bring about the salvage of identified cultural sites; however, these sites, once mined, would not be available for future study, when advanced techniques might be developed. Visual resources would be unavoidably altered by dominance of the landscape by mining activities and structures. Irreversible impacts to the landscape character would be the rounding and smoothing of rugged topographic areas.

Air quality would be unavoidably impaired by the generation of fugitive dust produced by surface mining if a leasing alternative was selected, and increased rail traffic would cause an increased delay for automobile traffic at at-grade crossings.

Increases in regional population would be unavoidable under the leasing alternatives, with the amount of increase dependent on the alternative selected. Impacts due to population increases would increase proportionately.

Adverse effects on social structure such as transience, impersonalization, social fragmentation, and conflicts between new and longtime residents would occur at a level dependent on the population change related to the leasing alternative selected.

ABBREVIATIONS

AVF	Alluvial valley floor
BIA	Bureau of Indian Affairs, U.S. Department of the Interior
BLM	Bureau of Land Management, U.S. Department of the Interior
Btu	British thermal unit
CFR	Code of Federal Regulations. Numbers refer to title and part; that is, 43 CFR 4100 refers to title 43, part 4100.
cfsm	Cubic feet per second per square mile
CONSOL	Consolidation Coal Company
dBA	"A" weighted decibels
DEQ	Department of Environmental Quality, Wyoming
DSL	Department of State Lands, Montana
EA	Environmental assessment. A record of the environmental factors involved in a land management action.
EIS	Environmental impact statement. A written analysis of the impacts of a proposed project and alternatives.
EPA	U.S. Environmental Protection Agency
ETSI	Energy Transportation Systems, Inc.
FCLAA	Federal Coal Leasing Amendments Act of 1976
FLPMA	Federal Land Policy and Management Act of 1976
FS	Forest Service, U.S. Department of Agriculture
gpm	Gallons per minute
GS	Geological Survey, U.S. Department of the Interior
MFP	Management framework plan. A BLM land use planning document.
mg/l	Milligrams per liter
NAAQS	National ambient air quality standards
NEPA	National Environmental Policy Act of 1969
NPRC	Northern Plains Resource Council
OSM	Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior
ppm	Parts per million
PRLA	Preference right lease application (defined in chapter 1)
PSD	Prevention of significant deterioration
SCS	Soil Conservation Service, U.S. Department of Agriculture
SMCRA	Surface Mining Control and Reclamation Act of 1977
TDS	Total dissolved solids
Tract Profile	See beginning of the Reference section
TSP	Total suspended particulates
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	U.S. Fish and Wildlife Service, Department of the Interior
VQO	Visual Quality Objective. A classification used by the Forest Service in its visual management system.
VRM	Visual resource management. A BLM program to protect scenic values and reduce the impact of development activities.

CHAPTER 1: PURPOSE OF AND NEED FOR THE ACTION

COAL LEASE SALES

Purpose

The federal coal management program is administered by the Department of the Interior through the Bureau of Land Management (BLM). The program provides for competitve leasing of federal coal to ensure that adequate coal supplies are available to meet national long-term energy requirements and that sufficient reserves are available to continue existing production.

The Secretary of the Interior on April 29, 1983, established a leasing level range of 1.2 to 4.85 billion tons of recoverable reserves for proposed secound round of coal leasing in the Powder River Region. Only federal coal is included in that leasing level.

The leasing level was established after analysis of potential production from planned and existing coal mines in the region and the projected demand for coal. This level was selected to ensure that sufficient coal resources would be offered to enhance industry competition. The selection of this level was based in part on new expressions of interest from industry totaling 3.1 billion tons, plus expressions totaling 3.4 billion tons "recycled" from the first round (1982) coal lease sale. To meet the leasing level established for the Powder River Region, the alternatives described in this document propose offering between 9 and 22 tracts for competitive leasing in 1984.

Need

The need for additional federal coal leasing is discussed in depth in the *Final Environmental Statement: Federal Coal Management Program* (USDI, BLM 1979a). Benefits of coal leasing defined in that study include greater assurance of meeting national energy objectives, significant legal and administrative advantages, and improvement of the state of competition in the Western coal industry. Another benefit mentioned is the promotion of more desirable patterns of coal development with the potential to reduce production costs and environmental impacts.

Overall guidance for the leasing process is provided by the Powder River Regional Coal Team, which is chaired by the BLM state director from Oregon. Other members of the team are the BLM state directors from Montana and Wyoming and representatives of the governors of Montana and Wyoming.

A detailed discussion of methodologies for determining coal leasing levels may be found in the leasing level paper attached to the regional coal team's leasing level recommendation of February 14, 1983. The paper is included in the minutes of the Powder River Regional Coal Team's meeting, which are available at the BLM's Wyoming State Office, 2515 Warren Avenue, Cheyenne, Wyoming 82001.

Factors considered in establishing the leasing level are productive capacity, inventory, contracting rate, expressions of interest, past sales, and minimum leasing. The inventory method yielded a leasing level of 1.4 to 3.8 billion tons; the contracting rate method indicated a range of 0.65 to 1.65 billion tons. Expression of interest methodology indicated a range of 2.5 to 3.1 billion tons, and a mimimum leasing methodology indicated a range of 1.4 to 2.4 billion tons.

Although there are some indications of a decrease in the market demand for reserves, industry has continued to express a significant level of interest in leasing federal coal in this region. A memorandum from the director of the Bureau of Land Management dated March 17, 1983, expresses the opinion that a leasing level of 1.2 to 4.85 billion tons of recoverable reserves will satisfy the demand, increase competition within the region, address the nation's energy needs, and provide for an inventory of leased reserves to accommodate any unforseen needs.

Background

The federal coal management program establishes coal production regions in the United States and provides for sales of coal leases in those regions to help meet the nation's projected energy demands. The area dealt with in this EIS is the Powder River Coal Region, which comprises all or parts of Natrona, Converse, Johnson, Campbell, Sheridan, Crook, and Weston counties in northeastern Wyoming and Rosebud, Big Horn, and Powder River counties in southeastern Montana. The coal region is portrayed on the Location map in the front of this document and the Regional Activity map in the back pocket.

Purpose and Need

The EIS for the first round of Powder River Coal Region leasing, the *Final Powder River Regional Coal Environmental Impact Statement* (USDI, BLM 1981b), was released in December 1981. Twelve tracts were sold in 1982, and leases have been issued for all of them. However, litigation was filed by the National Wildlife Federation and the Northern Cheyenne Indian Tribe against the leasing action. The complaints contended that land use planning had not been adequate and that effects on the Northern Cheyenne Indian Tribe had not been considered. A ruling is still pending on that litigation.

The Northern Plains Resource Council, in affiliation with the Tongue River Agricultural Protection Association, the Rosebud Protection Association, and the Tri-County Ranchers' Association, filed a petition alleging that certain lands in Rosebud and Powder River counties, Montana, were unsuitable for surface coal mining. That petition (Tongue River Petition, December 1980) was filed under section 522 of the Surface Mining Control and Reclamation Act of 1977. A petition evaluation document releasing in January 1982 by the Office of Surface Mining Reclamation and Enforcement (OSM), U.S. Department of the Interior, denied the petition.

In preparation for the second round of federal coal leasing in this region, the Powder River Regional Coal Team has held public meetings to consider the various phases of the process that has led to the publication of this EIS.

The federal coal leasing program is fully described in the *Federal Coal Management Regulations* (43 CFR 3400) and in the following publications by the Bureau of Land Management: *Final Environmental Statement: Federal Coal Management Program* (1979), *Secretarial Issue Document: Federal Coal Management Program* (n.d.), and *The Federal Coal Management Program: A Narrative Description.* File copies of these documents are available for inspection at the Bureau of Land Management, Office of Public Affairs, 18th and C Streets, NW, Washington, D.C. 20240.

Procedure

Land Use Planning

The first step in the coal leasing process is land use planning, through which areas are identified that are suitable to be considered for coal leasing. The potential coal lease tracts analyzed in this EIS have been delineated from the acceptable areas identified in the land use plans.

In identifying acceptable areas, the BLM applies the following four "screens."

Only areas with high or moderate potential for coal development area considered.

The unsuitability criteria of the federal coal management program are applied (43 CFR 3460), and areas found unsuitable for mining are excluded from consideration for leasing.

Multiple use decisions in land use planning may preclude coal development in certain areas.

Surface owner consultation permits owners to express preference for or against leasing. Some areas may be precluded from development if there is significant opposition.

The land use plans that have been completed are consistent with local and state land use plans. As a result of the unsuitability assessment, some areas have been dropped from further consideration for leasing. In addition, tract-specific mitigative measures have been developed to protect threatened or endangered wildlife species, alluvial valley floors, and other special features (see appendix C). Documentation of the land use planning process is on file at the BLM District Offices in Miles City, Montana, and Casper, Wyoming.

Expressions of Interest

After land use planning was completed, the BLM called for expressions of interest in leasing from industry. The expression of interest included information on the area of interest, desired tonnages, and whether surface or subsurface mining was proposed. The information is on file at the district offices in Casper and Miles City.

Tract Delineation and Tract Profiles

After receiving the expressions of interest, the BLM delineated tracts of high to moderate coal potential that might be offered for leasing. A "tract profile" was then prepared for each tract. Each profile combined a tract delineation report, which focused on the coal resource facts, and a site-specific analysis, which considered environmental, social, and economic factors. Tracts selected for further study are shown on the Regional Activity map at the back of this document.

Tract profiles are a concise presentation of tract-specific facts. They serve as the foundation for analysis of impacts associated with the proposed action: to lease coal in the Powder River Region and are integral to the regional cumulative analysis documented in this EIS, which is prepared for compliance with the Nation Environmental Policy Act of 1969.

The BLM also prepared a summary brochure, *Powder River Coal Region Tract Summaries* (USDI, BLM 1983), which served as a concise source of pertinent facts about the tracts. The tract profiles and the summary brochure are available upon request from the Casper BLM District Office, 951 Rancho Road, Casper, Wyoming 82601.

Tract Ranking and Selection

At a public meeting on June 21, 1983, the Powder River Regional Coal Team (1) ranked the tracts as having high, moderate, or low desirability for coal development, (2) selected tracts for consideration in the EIS, and (3) formulated leasing alternatives. Factors considered in ranking the tracts fall into three general categories: coal data, environmental data, and socioeconomic data. Table 1-1 contains information on the acreage and tonnage of each tract selected; table 1-2 contains more information on the ranking factors; table 1-3 shows the ranking of selected tracts. A detailed discussion of the ranking and selection process appears in the minutes of the coal team's meeting.

Formulation of Alternatives

The Powder River Regional Coal Team grouped the tracts into six alternatives, a "no leasing" alternative and five leasing alternatives. Table 1-4 shows the tracts included in each alternative. Alternative 2 contains only the highly desirable tracts, with successively higher leasing alternatives adding the tracts ranked "moderate" and "low." A "maintenance" tract, as listed on table 1-4, has a small quantity of reserves and could logically be mined as part of an existing operation. In contrast, a "competitive" tract contains sufficient reserves to open a new mine.

Alternative 1, the "no leasing" alternative, assumes that the current regional industrial development would continue but that no new competitive federal coal leases would be offered. Existing industrial developments, the "baseline" for this EIS, are listed in appendix B and are shown on the Regional Activitiy map.

Leasing alternatives as shown on table 1-4 cover a range of coal reserves from 0.997 billion tons to 4.515 billion tons. This range is only slightly lower than the recommended coal leasing level for the region. A 900-megawatt coal-fired generator has been proposed in the development of the Mud Springs tract. That tract is included in Alternatives 3, 4, and 6.

On the basis of the analysis of alternatives in this EIS, the BLM recommends that Alternative 5 be selected as the preferred alternative. This recommendation of the BLM does not reflect the desires or wishes of the Powder River Regional Coal Team or the Governors of Wyoming or Montana. It was selected for purposes of analysis only, and the recommendation is subject to change.

Public Involvement

Meetings

After the release of the coal leasing level decision and selection of tracts, the Powder River Regional Coal Team held scoping meetings in May and July 1983 to identify public conerns and to allow the public to review and comment on the issues and alternatives. The meetings were held as follows: Gillette, Wyoming, May 24; Sheridan, Wyoming, May 25; Ashland, Montana, May 26; Hardin, Montana, July 12; and Sheridan, Wyoming, July 13. Written comments were accepted for a 15-day period after each round of meetings. Comments received did not result in identification of any totally new issues within the scope of the EIS, but the preliminary issues were elaborated on, and concerns were expressed about specific areas or conflicts.

Issues

Issues identified through the BLM's land use planning system and through the scoping process, and determined to be within the scope of the EIS, are as follows:

General

The effectiveness of mitigation

Impacts on agriculture from mining

The effect of not maintaining a coal industry

TABLE 1-1
COAL DATA BY TRACT

	Coal Ownership (acres)					Recoverable Reserves (millions of tons)					
Tract	Federal Uncommitted	Federal Committed	State	Private	Total	Federal Uncommitted	Federal Committed	State	Private	Total	Companies Expressing Interest
Wyoming											
Youngs Creek	3,310		640	635	4,585	388		53	94	535	Coastal States Energy; Ash Creek; Shell; Basin Elec.; Central & Southwest Fuels; Western Fuels
Hidden Water	6,285		640	1,960	8,885	163		100	19	282	Peter Kiewit & Sons
Calf Creek	6,010	360	640	40	7,050	694	16	28	3	753	Shell; U.S. Steel; Old Ben; Texaco; Mobil
Hay Creek	5,250		120		5,370	447		16		463	Old Ben; Texaco; Mobil; Peter Kiewit & Sons
*Donkey Creek	600	700	640		1,940	49	75	4		128	Wyodak Rsces. Devel. Co.
Timber Creek	3,350			400	3,750	165			9	174	Bridgeview Coal Co.
Mount Logan	6,165		640		6,805	410		42		452	U.S. Steel; Exxon; Gulf
Kintz Creek	4,080			120	4,200	282				284	Wymo; NERCO, Inc.; Exxon; Gulf; U.S. Steel; Shell
Thundercloud	3,845		640	40	4,525	445		78	5	528	Anaconda Mining Co.
*Porcupine	560	160			720	26	13			39	North Antelope Coal Co.; Rochelle Coal Co.
Ridgerunner	4,610		720		5,330	415		25		440	NERCO, Inc.
Wyoming total	44,065				53,160	3,484				4,078	
Montana											
*Colstrip Maintenance	240				240	2				2	Western Energy
*Colstrip Area C	1,481	842	76	2,737	5,136	34	21		40	95	Western Energy
*Spring Creek	280	2,365	640		3,285	11	232	16		259	NERCO, Inc.
*North Decker I[a]	510	2,361			2,871	14				14	Decker Coal Company
*North Decker II[a]	921	2,361			3,281	13				13	Decker Coal Company
*Wolf Mountain Maintenance	598	524		249	1,371	31	34		18	83	Peter Kiewit & Sons
Downey Coulee	4,709		640	6,506	11,855	77		6	116	199	Peabody Coal; Meridian Land and Mineral
Ashland (Decker-Birney)	1,949		640	2,939	5,528	110		51	186	347	Cities Service Company; Meridian Land and Mineral
Northwest Otter Creek	1,350		640	3,484	5,475	89		56	173	318	Cities Service; Chevron; Meridian
Hanging Woman	9,144		720		9,864	373		27		400	Kendrich Cattle Co.; Lee Techni-Coal for Cyprus Coal Co.
Mud Springs	7,720		480		8,200	277		23		300	Utah International
Montana total	28,902				57,106	1,031				2,030	
Region total	72,967				110,266	4,515				6,108	

* Maintenance tracts.

[a] Committed coal is the same for North Decker I and North Decker II.

TABLE 1-2
TRACT RANKING FACTORS

Coal Resource Data

- Economic viability
  - Ratio of recovered BTUs per acre of surface disturbance
  - Energy production potential: to what extent is development of the tract economically feasible? How likely is development? (Economy of scale is included.)
  - Transportation: Proximity of mine to expected use or transportation facility. (Requirements for new construction are taken into account.)
  - Bypass potential if tract is not mined at this time.
- Potential for later delineation. (This relates to tracts carried over from the first round. Would deferring sale of tract make possible a more viable tract for a later sale?)
- Expansion of existing mines
- Inclusion of state lands (tracts that contain state lands are ranked higher than those without state lands)

Effects on the Natural Environment

- Wildlife habitat
- Reclamation potential
- Effects on quality and quantity of surface water and groundwater
- Effects on air quality

Socioeconomic Effects

- Disruption of family farms/ranches
  - Reduction of economic viability of each farm/ranch unit.
  - Loss of family farm concept
- Changes in agricultural productivity
  - Temporary loss of land to mining
- Changes in rural quality of life
- Changes in communities, Indian reservations, local community services
- Conflict with other plans or policies (state and local) for development

Minerals

The relationship of preference right lease applications to the coal leasing program and the EIS

The need for new leasing

Soils

Impacts on stabilization of soils

Vegetation

Questions about types of vegetation used for reclamation

Loss of riparian vegetation

Water Resources

Impacts on water quality from the contamination, aquifer destruction, and increased population

Impacts on water quantity, including water availability for other users, increased populations, and maintenance of existing operations.

Land Use

No contact with adjacent landowners by mining interests

Impacts of living next door to a coal mine

Wildlife

Impacts on wildlife habitat

Cultural Resources

Impacts on cultural resource values and religious sites

Noise

Impacts of increased noise levels

TABLE 1-3
RANKING OF SELECTED TRACTS

Tract	Recoverable Reserves (in millions of tons)		Coal Factors	Environmental Factors	Socioeconomic Factors	Overall Ranking
	Federal	Total				
Wyoming						
Youngs Creek	388	535	H	H	H	H
Hidden Water	163	282	L	H	H	M
Calf Creek	694	753	H	M	M	M
Hay Creek	447	463	M	H	H	H
Donkey Creek	49	128	H	H	H	H
Timber Creek	165	174	H	H	H	H
Mount Logan	410	452	M	M	M	M
Kintz Creek	282	284	M	H	H	H
Thundercloud	445	528	H	H	H	H
Porcupine	26	39	H	H	H	H
Ridgerunner	415	440	H	H	H	H
Montana						
Colstrip Maintenance	2	2	H	H	H	H
Colstrip Area C	34	95	H	H	H	H
Spring Creek	11	259	H	H	H	H
North Decker I	14	14	H	H	H	H
North Decker II	13	13	M	H	H	H
Wolf Mountain Maintenance	31	83	H	H	H	H
Downey Coulee	77	199	M	L	L	L
Ashland (Decker-Birney)	110	347	M	L	L	L
Northwest Otter Creek	89	318	M	L	L	L
Hanging Woman	373	400	M	M	L	M
Mud Springs	277	300	M	M	L	M

NOTE: "H" indicates high desirability for leasing, not high impact to the factor considered.
"M" indicates medium desirability for leasing; "L", low desirability.

TABLE 1-4
ALTERNATIVES FOR PROPOSED 1984 COAL LEASE SALE
POWDER RIVER REGION
(federal uncommited recoverable reserves in billions of tons)

	Reserves	Totals
ALTERNATIVE 1		
No Leasing		
ALTERNATIVE 2		
Wyoming Tracts	Reserves	Totals
Thundercloud[a](H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Wyoming total		0.892
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Montana total		0.105
ALTERNATIVE 2 TOTAL		0.997
ALTERNATIVE 3		
Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Wyoming Total		0.892
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Montana total		0.492
ALTERNATIVE 3 TOTAL		1.384
ALTERNATIVE 4		
Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Wyoming total		1.716
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Northwest Otter Creek(L)	0.089	
Montana total		0.581
ALTERNATIVE 4 TOTAL		2.297
ALTERNATIVE 5		
Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Donkey Creek (mtce.)(H)	0.049	
Hidden Water(M)	0.163	
Wyoming total		1.928
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Northwest Otter Creek(L)	0.089	
Hanging Woman(M)	0.373	
Montana total		0.677
ALTERNATIVE 6		
Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek (H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Donkey Creek (mtce.)(H)	0.049	
Hidden Water(M)	0.163	
Calf Creek(M)	0.694	
Hay Creek(H)	0.447	
Ridgerunner(H)	0.415	
Wyoming total		3.484
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Northwest Otter Creek(L)	0.089	
Hanging Woman(M)	0.373	
Downey Coulee(L)	0.077	
Montana total		1.031
ALTERNATIVE 6 TOTAL		4.515

---

[a] Letters in parentheses indicate ranking of the tract's desirability for leasing as high, moderate, or low.

[b] Maintenance tracts in Montana are as follows (billions of tons in parentheses): North Decker I (0.014), Colstrip C (0.034), Wolf Mountain Maintenance (0.031), Spring Creek (0.011), Colstrip Maintenance (0.002), and North Decker II (0.013).

Air Quality

Impacts on air quality

The total number of air quality permits in the region

Visibility standards and impacts on Class I areas in the region

Transportation

Impacts on transportation systems (highways and railroads)

Economics and Social Values

Impacts on local governments

Impacts on community facilities such as housing, roads, schools, water and sewer facilities, police and fire protection, and health care

Impacts to Indian reservations

Impacts on lifestyles

Impacts on local labor forces—unemployment from imported labor forces and population increases

Issues Not Addressed

Some of the issues identified before and during the scoping process are beyond the scope of the EIS, have been covered by prior environmental review, or are not considered to have a significant effect on human environment within the area of study. Those issues are listed below.

Whether it is advisable to lease additional coal while the current coal market is soft; the possibility of selling public resources in a manner that maximizes, through competition, the monies returned to the federal, state, and local treasuries

The ability of surface owners to manipulate the sale of lease tracts

Impacts associated with construction of the coal slurry pipeline by Energy Transportation Systems, Inc.

OTHER TYPES OF COAL LEASING

In certain circumstances federal coal leases may be granted by other means than in competitive lease sales. Other methods of coal leasing in the Powder River Region are described below.

I-90 Exchanges

Public Law 95-554, dated October 30, 1978, authorized the Secretary of the Interior to consider the exchange of specific coal leases that are crossed by Interstate Highway 90 for leases on other federal coal. Six leaseholders were affected by this law. Carter Mining Company received an exchange in 1982. The proposals for exchange of three applicants, Carter, Gulf, and Wyodak, were analyzed in the EIS for the 1982 coal lease sale (USDI, BLM 1981b). Three other proposals for exchange, from Big Horn, Kerr-McGee, and Belco, are assessed in this document as part of the baseline. Site-specific environmental assessments (EAs) will be prepared at a later date.

Preference Right Lease Applications

Under the Mineral Leasing Act of 1920, the Secretary of the Interior was authorized to issue exploration permits for land where the existence or workabiity of coal resources was unknown. A permittee who could demonstrate, during the term of the permit, the existence of commercial quantities of coal was entitled to a "preference right lease"—that is, a noncompetitive lease. Provisions for prospecting permits were repealed in 1976, but current federal coal regulations (43 CFR 3430) provide for processing of pending preference right lease applications (PRLAs).

There are 67 PRLAs in the Powder River Region. Seven PRLAs have been rejected; all are under appeal. The cumulative impacts of development of these PRLAs, as depicted in the initial showings submitted by the applicants, are assessed as part of the baseline in this document. Site-specific EAs have been done for all of these PRLAs.

Northern Cheyenne Coal Exchanges

Under Public Law 96-401, the Secretary of the Interior is authorized and directed to negotiate a cancellation agreement between the Northern Cheyenne Indian Tribe and parties holding leases or permits on tribal land. Such an agreement would provide for issuance of a noncompetitive lease for lands adjacent to existing operations and/or for issuance of a certificate of a coal lease bidding right for an amount equal to the investment made by each party.

The deadline for an agreement on leases was November 1, 1980, and permits had to be agreed upon by January 1, 1982. Peabody Coal Company, with six leases and three permits, made a settlement agreement with the Northern Cheyennes on October 30, 1980, for a noncompetitive lease on lands in Rosebud County, Montana. This agreement, which covered the Greenleaf-Miller project, is included as part of the baseline of this EIS.

Eight other permits were held by five other parties. AMAX negotiated successfully for lands adjacent to the Belle Ayr Mine in Campbell County, Wyoming. Consolidation Coal Company (CONSOL), with one permit, is seeking lands adjacent to its CX Ranch property in Big Horn County, Montana. Chevron Oil Company, with one permit, is negotiating with CONSOL for a percentage of CX Ranch and is seeking land adjacent to that lease. Negotiations with the remaining permit holders were not concluded before the statutory deadline. Any pending claims for compensation will now have to be submitted to the U.S. Court of Claims for resolution.

Substantial amounts of economic coal reserves are available for leasing on the Crow and Northern Cheyenne Indian reservations, at each tribe's discretion.

Energy Transportation System, Incorporated (ETSI) is scheduled to complete its coal slurry pipeline in 1985. Coal for the pipeline will be supplied by the North Rawhide, North Antelope, and Jacobs Ranch mines, which are under construction or in production. A full analysis of the ETSI proposal, including water use, may be found in the *Draft Environmental Impact Statement on the Energy Transportation Systems, Inc., Coal Slurry Pipeline Transportation Project* (USDI, BLM and Woodward-Clyde 1980).

LEGISLATION AND REGULATIONS

The development of federal coal resources is controlled by a number of federal and state laws and regulations. The most important federal laws are the Federal Coal Leasing Amendments Act of 1976 (FCLAA), the Federal Land Policy and Management Act of 1976 (FLPMA), and the Surface Mining Control and Reclmation Act of 1977 (SMCRA), and the National Environmental Policy Act of 1969 (NEPA). The federal coal EIS contains a detailed discussion of the related legislation and regulations (USDI, BLM 1979a).

FCLAA provides a more orderly procedure for the leasing and development of federal coal than was set forth in its parent document, the Mineral Leasing Act of 1920. In particular, the FCLAA specifies that land use planning must be completed before federal coal is leased, that coal must be leased only through competition, and that the government must receive fair market value.

FLPMA provides the BLM with a statutory framework for land use planning on public lands. It requires that the BLM use the principles of multiple use and sustained yield, give priority to the protection of areas of critical environmental concern, consider present uses of public land as well as future uses, and coordinate planning activities with those of state and other federal agencies.

SMCRA regulates mining and reclamation on state and private land. It permits state regulation of these activities on federal lands, provided the state has a program approved by the Office of Surface Mining and has entered into an agreement with the Secretary of the Interior for regulation of surface coal mining activities on federal lands. Montana's and Wyoming's programs for implementing these provisions have been approved by the Secretary of the Interior, and both states have entered into cooperative agreements with the Department of the Interior. Thus, both states have primary responsibility for ensuring that the environment is adequately protected and that standards are maintained in surface mining and reclamation on federal, state, and private lands. However, specific federal responsibilities, such as protection of threatened or endangered species, have not been delegated to the states.

Each lease operator is required to submit a permit application package that complies with the appropriate state/federal cooperative agreement and regulations incorporated therein, and with 43 CFR 3480. The application must demonstrate that economic coal recovery has been evaluated and that resources other than coal will be protected. The permit application package must be approved by the state regulatory authority. The Assistant Secretary for Energy and Minerals, Department of the Interior, must approve the resource recovery and protection plan, which is part of the permit application package.

SCHEDULE OF FURTHER ACTIVITY

Upon release of the final EIS in March of 1984, the regional coal team will make recommendations to the director of the BLM as to (1) which specific tracts of the 22 analyzed should be offered for lease sale and (2) if appropriate, a schedule for the lease sale. The director will forward these recommendations, along with his own, to the Secretary of the Interior, who will make the final decision on which tracts and how many are to be offered. The Secretary of the Interior has discretion to select for leasing any combination of tracts analyzed in the EIS. The Secretary of the Interior also will determine the schedule of tract sales.

The second round of competitive coal lease sales in the Powder River Region is tentatively scheduled to begin in August 1984.

CHAPTER 2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter provides a narrative description of the six alternatives analyzed in this document and a series of tables summarizing relevant data such as recoverable reserves by tract and alternative, population changes, and acreage disturbances for each alternative. Also provided is a list of the types of mitigating measures applied. Table 2-1 gives a comparative analysis of impacts associated with the six alternatives.

The major consequences of each alternative are summarized in this chapter. The individual tract profiles contain site-specific analysis of the impacts of development of each tract included in the alternatives. That analysis includes consideration of agricultural economics.

Because documented evidence of damage to the agricultural production of farms and ranches in the vicinity of a coal mine has not been demonstrated, and because documented analysis has suggested that land values of farms and ranches have been enhanced by coal mines in the vicinity (Moore 1983), we have decided that the analysis of agicultural economics contained in the 1981 coal EIS (USDI, BLM 1981b, appendix G) and in the individual tract profiles prepared for the tracts being studies for sale is adequate. Therefore, further analysis of agricultural economics will not be undertaken.

THE ALTERNATIVES

The alternatives are directed toward leasing various combinations of tracts to make specific tonnages of coal available for production. Table 1-4 in chapter 1 lists the tracts that would be offered for leasing under each alternative and the tonnage of federal uncommitted recoverable reserves in each tract.

For analytical purposes it is assumed that all tracts offered under each alternative will be leased and, further, that they will be mined in the period covered by this analysis. The impact analysis for Alternative 6 represents the maximum development possible. Figure 2-1 shows the annual production capacity for each alternative in selected years.

TRACTS OF SPECIAL INTEREST

Mud Springs

In its expression of interest in the Mud Springs tract, Utah International indicated it would use coal from the tract on the site for generation of electricity. The facility would include two 450-megawatt generating plants that would employ a permanent work force of approximately 200. The workforce for construction of the power plant and associated facilities would peak at 2,800 employees.

The Mud Springs tract is included in Alternatives 3, 4, and 6. Wherever the effects from development of this tract are discussed, we have assumed that if this tract was leased, the coal-fired generators would be built on the site.

If the generating plant were built as described, cooling water probably would be obtained from the Powder River in the amount of 13,000 acre-feet per year.

The most restrictive air quality regulation is the 24-hour maximum allowable increase in sulfur dioxide of 5 micrograms per cubic meter. This is the federal, Wyoming, and Montana standard for prevention of significant deterioration in a Class I area. The maximum predicted increment in sulfur dioxide due to the generating plants would be 2.1 micrograms per cubic meter at the boundary of the Northern Cheyenne Indian Reservation (PEDCo 1983)—well below the standard.

Bitter Creek

The Bitter Creek tract was among those described in an individual tract profile and summarized in the tract summary report (USDI, BLM 1983). However, the tract was not selected for inclusion in any alternative because its overall desirability for leasing was low. Economic development of this isolated tract's coal would be hampered by a high stripping ratio and a low British thermal unit (Btu) content, and at least 35 miles of railroad spur would be required. Steep terrain and a probable alluvial valley floor are other concerns.

TABLE 2-1
COMPARISON OF ALTERNATIVES
CUMULATIVE ENVIRONMENTAL IMPACTS

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
GEOLOGY AND MINERALS						
Potential annual coal production resulting from new federal leasing (million tons)	98 + (sig)	128.5 + (sig)	144.6 + (sig)	177.6 + (sig)	197.1 + (sig)	256.8 + (sig)
Net energy analysis (Btus produced to Btus consumed)	230 to 1 + (sig)	232 to 1 + (sig)	230 to 1 + (sig)	231 to 1 + (sig)	231 to 1 + (sig)	225 to 1 - (sig)
SOILS AND RECLAMATION						
Total acreage to be reclaimed*	333,700 - (sig)	355,700 - (sig)	372,000 - (sig)	391,300 - (sig)	402,800 - (sig)	444,800 - (sig)
Coal acreage to be reclaimed	293,900 - (sig)	314,060 (non)	327,790 - (sig)	345,380 - (sig)	356,270 - (sig)	394,070 - (sig)
WATER RESOURCES						
Groundwater						
Maximum number of wells destroyed or affected through mine life	275 - (sig)	333 - (sig)	368 - (sig)	384 - (sig)	375 - (sig)	425 - (sig)
Number of springs destroyed	25 - (sig)	29 - (sig)	35 - (sig)	35 - (sig)	28 - (sig)	49 - (sig)
Acre-feet of water needed for coal mining in 1990	9,340 - (sig)	9,950 (non)	10,270 (non)	11,000 - (sig)	11,240 - (sig)	12,590 - (sig)
Acre-feet of municipal water needed by 1990 population	38,000 - (sig)	38,990 (non)	40,556 (non)	41,844 (non)	41,205 (non)	43,900 - (sig)
Surface Water						
Reduction in surface outflow (maximum through mine life)						
Cheyenne River	2.20% (non)	3.10% (non)	3.10% (non)	3.10% (non)	3.10% (non)	3.80% (non)
Tongue River	0.09% (non)	0.09% (non)	0.12% (non)	0.13% (non)	0.16% (non)	0.44% (non)
Maximum number of point watering sources lost through mine life	108 - (sig)	164 - (sig)	183 - (sig)	204 - (sig)	220 - (sig)	287 - (sig)

* These figures apply to all energy-related actions on and off the sites of the developments.

Symbols: "+" = positive; "-" = negative; "sig" = significant; "non" = nonsignificant.

(continued on next page)

COMPARISON OF ALTERNATIVES--CUMULATIVE ENVIRONMENTAL IMPACTS (continued)

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
WATER RESOURCES (continued)						
Surface Water (continued)						
Increase in dissolved solids concentration						
Cheyenne River	5.6% - (sig)	6.3% - (sig)	6.3% - (sig)	6.3% - (sig)	6.3% - (sig)	6.9% - (sig)
Tongue River	1.4% (non)	1.7% (non)	3.5% (non)	4.1% - (sig)	4.3% - (sig)	7.2% - (sig)
AIR QUALITY						
Predicted violations in 1990	a (non)	a,b (non)	a,b (non)	a,b (non)	a,b (non)	a,c (non)
TRANSPORTATION FACILITIES						
Total number of unit coal trains per day	210 - (sig)	227 (non)	234 - (sig)	255 - (sig)	261 - (sig)	289 - (sig)
Average hours and minutes per day that at-grade crossings would be occupied (at 20 m.p.h.)	5:51 - (sig)	6:00 (non)	6:06 - (sig)	6:33 - (sig)	7:03 - (sig)	8:06 - (sig)
Probable number of car-train accidents at at-grade crosings per 1,000 vehicles per day per 100 years	13 - (sig)	14 (non)	14 (non)	16 - (sig)	17 - (sig)	19 - (sig)
SOCIOLOGY AND ECONOMICS						
Population in 1990						
Wyoming						
Campbell County	45,600	48,400	48,400	50,000	50,100	54,700
Converse County	16,700	16,900	16,900	17,200	17,200	18,100
Crook County	5,800	5,900	5,900	5,900	5,900	6,000
Goshen County	14,600	14,800	14,800	15,000	15,100	15,500
Johnson County	8,100	8,200	8,200	8,200	8,300	8,400
Natrona County	83,800	84,900	84,900	85,900	87,400	88,300
Niobrara County	3,200	3,220	3,220	3,240	3,250	3,300
Platte County	9,200	9,400	9,400	9,500	9,500	9,800
Sheridan County	32,600	33,000	35,700	37,600	36,900	40,300
Weston County	9,900	10,000	10,000	10,100	10,100	10,300

---

a. No violation of federal standards is predicted.

b. Wyoming standards would be violated on Thundercloud, and Kintz Creek tracts; Montana standards would be violated on North Decker I and North Decker II tracts.

c. Wyoming standards would be violated on Thundercloud, Kintz Creek, and Calf Creek tracts; Montana standards would be violated on North Decker I, North Decker II, and Downey Coulee tracts.

(continued next page)

COMPARISON OF ALTERNATIVES--CUMULATIVE ENVIRONMENTAL IMPACTS (continued)

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
SOCIOLOGY AND ECONOMICS (continued)						
Population in 1990 (continued)						
Montana						
Big Horn County	15,600	15,600	16,600	16,700	17,200	17,900
Powder River County	4,640	4,640	7,500	8,200	6,100	8,200
Rosebud County	14,500	14,500	16,200	16,900	16,200	18,000
Crow Indian Reservation	8,200	8,200	8,700	8,700	9,000	9,400
Northern Cheyenne Indian Reservation	5,300	5,300	5,700	5,800	5,600	6,200
Total Population	264,240 - (sig)	269,460 (non)	277,720 (non)	284,440 - (sig)	283,250 - (sig)	298,800 - (sig)

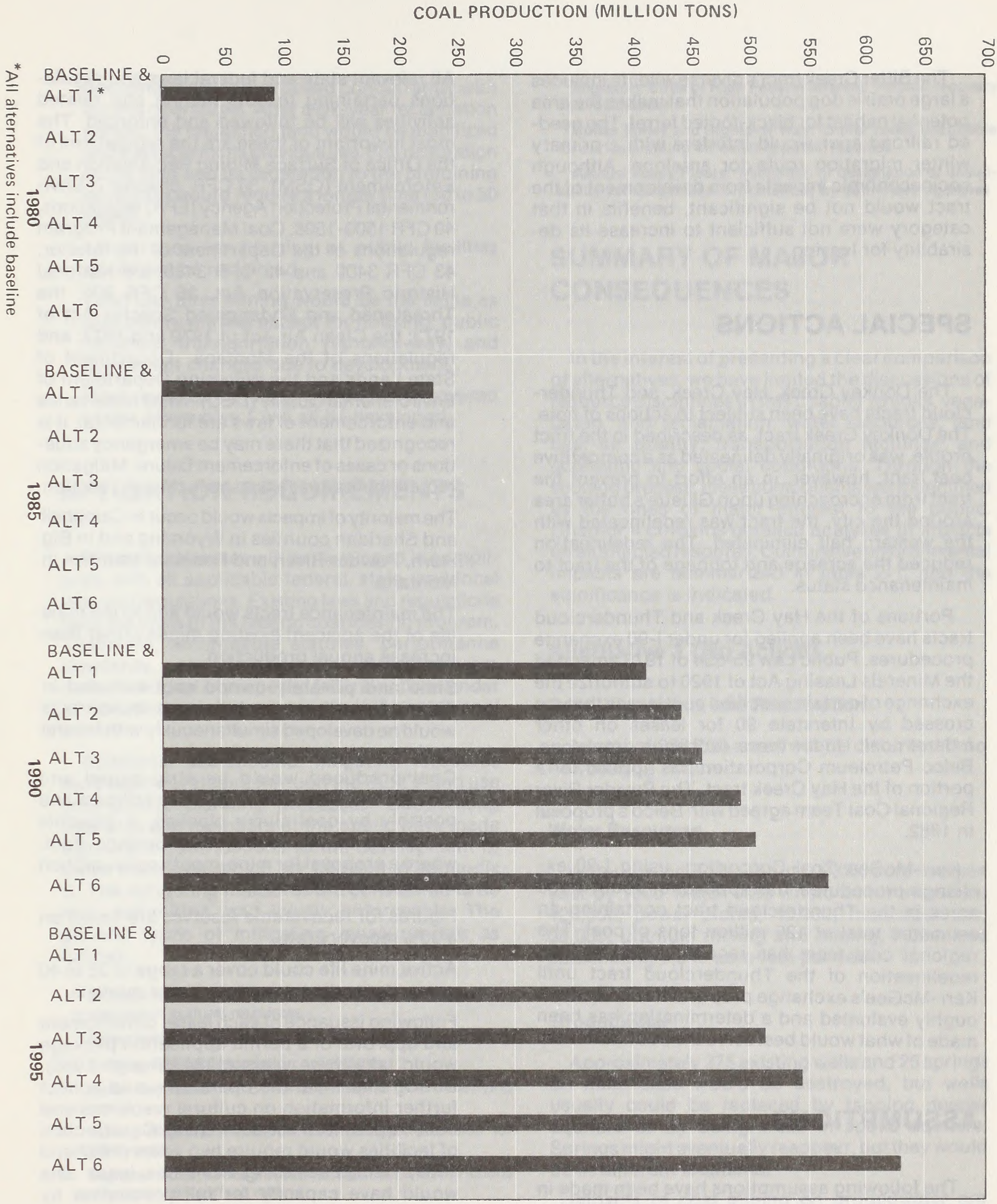


Figure 2-1
POWDER RIVER REGIONAL
ANNUAL COAL PRODUCTION CAPACITY
TO 1995

The Bitter Creek tract's diverse wildlife includes a large prairie dog population that makes the area potential habitat for black-footed ferret. The needed railroad spur would interfere with a primary winter migration route for antelope. Although socioeconomic impacts from development of the tract would not be significant, benefits in that category were not sufficient to increase its desirability for leasing.

SPECIAL ACTIONS

The Donkey Creek, Hay Creek, and Thundercloud tracts have been subject to actions of note. The Donkey Creek tract, as described in the tract profile, was originally delineated as a competitive coal tract; however, in an effort to prevent the tract from encroaching upon Gillette's buffer area around the city, the tract was redelineated with the western half eliminated. The redelineation reduced the acreage and tonnage of the tract to maintenance status.

Portions of the Hay Creek and Thundercloud tracts have been applied for under I-90 exchange procedures. Public Law 95-554 of 1978 amended the Minerals Leasing Act of 1920 to authorize the exchange of certain specified coal leases that are crossed by Interstate 90 for leases on other federal coal. Under these exchange provisions, Belco Petroleum Corporation has applied for a portion of the Hay Creek tract. The Powder River Regional Coal Team agreed with Belco's proposal in 1982.

Kerr-McGee Coal Corportion, using I-90 exchange procedures, has applied for about 1,100 acres in the Thundercloud tract containing an estimated total of 120 million tons of coal. The regional coal team has recommended against redelineation of the Thundercloud tract until Kerr-McGee's exchange proposal has been thoroughly evaluated and a determination has been made of what would best serve the public interest.

ASSUMPTIONS

The following assumptions have been made in analyzing the environmental impacts of mining and coal-related development considered in this EIS:

All relevant state and federal laws and regulations pertaining to coal mining and related activities will be followed and enforced. The most important of these are the regulations of the Office of Surface Mining Reclamation and Enforcement (OSM), 30 CFR, chapter 7; Environmental Protection Agency (EPA) regulations, 40 CFR 1500-1508; Coal Management Program regulations of the Department of the Interior, 43 CFR 3400 and 43 CFR 3480; the National Historic Preservation Act, 36 CFR 800; the Threatened and Endangered Species Act of 1973; the Clean Air Act of 1970 and 1977; and regulations of the Montana Department of State Lands and the Wyoming Department of Environmental Quality (DEQ). While observance and enforcement of laws are fundamental, it is recognized that there may be emergency situations or cases of enforcement failure. Mitigation requirements are discussed in the next section.

The majority of impacts would occur in Campbell and Sheridan counties in Wyoming and in Big Horn, Powder River, and Rosebud counties in Montana.

The maintenance tracts would add to the mine life of the adjacent existing mines rather than increase annual production.

State and privately owned coal included in federal lease tracts or adjoining those tracts would be developed simultaneously with federal coal.

Coal produced would be strip-mined and transported from the region by railroad and possibly by coal slurry pipeline. A possible exception to this is the Mud Springs tract, where a proposal for mine-mouth consumption would be considered.

Figures for recoverable reserves are based on a 90% recovery rate.

Active mine life could cover a range of 35 to 40 years, depending on reserves and markets.

Following issuance of each lease, development and approval of a permit application package would take three years (1984 through 1986). During that time, the operator would collect further information on cultural resources and obtain a permit for surface mining. Construction of facilities would require two years (1987 and 1988). Mines resulting from this lease sale would have capacity for full production by 1990, except the Mud Springs tract, which would have capacity for full production in 1992.

Reclamation would proceed concurrently with mining operations. After a six-year reclamation period, the reclaimed land would be stabilized and available for its previous use. Full restoration of the land and its vegetation to the premining condition would require a longer time (30 to 50 years).

Lands used for housing or public facilities would not be reclaimed.

Land use after mining would be the same as that before mining except for housing, public facilities, transportation rights-of-way, and permanent changes due to development.

Coal reserves included in the PRLAs covered under Alternative 1 will all be developed.

MITIGATION REQUIREMENTS

Federal coal leases will be developed in compliance with all applicable federal, state, and local laws and regulations. Existing laws and regulations form the basis of the federal coal leasing program. Therefore, enforceable statutes, performance standards, and other license requirements are considered part of proposed federal actions under all alternatives and are applicable to all coal tracts.

Additional site-specific mitigating measures have been developed through the BLM's land use and activity planning processes. Cooperating agencies and members of the public have made significant contributions to the development of these measures, which are detailed in appendix C. The mitigating measures are considered to be real, committed, and legally enforceable. The general types of mitigating measures are as follows.

Cultural Resources: Field inventories and procedures for protection of cultural resources

Paleontological Resources: Survey and resource recovery

Existing Rights: Negotiation procedures

Soils: Separation of "B" horizon material from underlying material

Survey Markers: Protection from damage; provision for replacement

Raptors: Buffer zones around nesting areas and restrictions as necessary on surface mining

Black-Footed Ferret Habitat: Monitoring and inventory in accordance with prescribed guidelines

Migratory Birds of High Federal Interest: Habitat recovery and replacement

Buffer Zones and Rights-of-Way: Buffer zones unsuitable for surface mining for existing public facilities

Alluvial Valley Floors: Mitigation or designation of unsuitability pending final determinations by authorized agencies

SUMMARY OF MAJOR CONSEQUENCES

In the interest of presenting a clear comparison of alternatives, we have limited the discussions of resource disciplines in this chapter to soils, vegetation, and reclamation; water resources; land use; air quality; transportation facilities; and economic and social conditions. Through the scoping process, these components were identified as the ones of major interest to the public. Chapter 4 contains detailed analyses of impacts on all affected resoures. Cumulative environmental impacts are summarized in table 2-1, and the significance is indicated.

Alternative 1 (No Action)

Soils, Vegetation, and Reclamation

A total of 333,700 acres will be disturbed if no new leasing occurs.

Water Resources

Water use would be about 600,000 acre-feet per year by 1990. Major uses would be for irrigation, 420,000; power plants, 46,000; municipal use, 38,000; uranium milling and mining, 7,000; and coal mining 9,340 acre-feet per year.

Groundwater

Approximately 275 existing wells and 25 springs on mine sites would be destroyed, but wells usually could be replaced by tapping deeper aquifers or by using wells in spoils aquifers. Springs might eventually reappear, but they would be in different locations.

Impacts of coal mining on groundwater are restricted to an area within a few miles of the mine site. Water levels in wells near a mine would be lowered during mining but would return to near premining levels after the site was restored.

Recharge would probably increase in many areas because the postmining slope of the land surface would be less steep and because reclamation practices to retain moisture and prevent erosion would increase infiltration. Shale layers that may have caused springs and seeps would be destroyed; however, the increased infiltration might cause increased groundwater inflow to streams or the creation of new springs and seeps near the mine site. Population increase associated with the "no new leasing" alternative would require 11,275 acre-feet of additional supplies by 1990.

Surface Water

The interception and use of water in mining operations and water consumption by the increased population would reduce surface outflow from the region by about 3,113 acre-feet per year (0.5%) during mining. The greatest reductions in flow would occur in the Little Powder and Cheyenne rivers, where flows might decrease more than 2%.

The total dissolved solids (TDS) concentrations of streams might increase as a result of leaching from coal spoils and increased sewage effluent. The maximum increase in TDS would range from 0.4% in the Powder River to 5.6% in the Cheyenne River. The increase in TDS would be long-term but would have no significant impact on current uses of the water or on aquatic biology downstream. The TDS of the Yellowstone and North Platte rivers would not be increased measurably.

Land Use

Under Alternative 1, no new mining properties would be added. The baseline impacts would be those caused by the regional industrial developments listed in appendix B.

Air Quality

Under Alternative 1, in which no new federal leasing would occur, regional changes in air quality resulting from new lease development, coal exchanges, PRLA development, and population increases would be insignificant. However, impacts near the Belle Ayr, Black Thunder, and Jacobs Ranch mines would violate standards on some occasions. Estimated emissions of total suspended particulates (TSP) from all mining sources under this alternative would be 34,044 tons in 1995.

Transportation Facilities

There would be no change from the baseline under Alternative 1. Table 4-10 and figure 4-1 in chapter 4 show the number of trains per day for selected towns. Table 4-10 also shows the at-grade interruptions and accident rates for each alternative. The figures for all alternatives are based on production potential; the actual number of trains would depend upon contracts and coal demand.

Economic and Social Conditions

Because the brunt of negative socioeconomic impacts due to coal development arises from population changes, this section will summarize the incremental changes in population under each alternative (see table 2-2). It is estimated that peak increases in population will occur by 1990.

In general, each succeeding alternative that contains additional leasing proposals would present an increasing change in peak population, except in Sheridan County, Powder River County, Rosebud County, and the Northern Cheyenne Indian Reservation. For the exceptions, Alternative 5 clearly would present a smaller change in peak population than the other leasing alternatives; thus, it has the potential for a more favorable ratio of benefits (from jobs and revenues) to costs (from population and expenditures).

TABLE 2-2
INCREMENTAL POPULATION CHANGES RESULTING FROM EACH NEW LEASING ALTERNATIVE
IN THE POWDER RIVER REGION

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Eastern and Western Powder River Region[a]						
Campbell County						
1988	0	510	510	740	760	1,430
1990	0	2,830	2,830	4,400	4,500	9,100
1995	0	2,830	2,830	4,400	4,500	9,100
Converse County						
1988	0	30	30	60	70	120
1990	0	240	240	450	510	1,420
1995	0	240	240	450	510	1,420
Crook County						
1988	0	10	10	10	10	30
1990	0	50	50	100	110	210
1995	0	50	50	100	110	210
Goshen County						
1988	0	30	30	60	60	110
1990	0	220	220	410	470	850
1995	0	220	220	410	470	850
Johnson County						
1988	0	10	10	20	20	40
1990	0	80	80	140	160	290
1995	0	80	80	140	160	290
Natrona County						
1988	0	170	170	290	340	570
1990	0	1,140	1,140	2,140	3,600	4,500
1995	0	1,140	1,140	2,140	3,600	4,500
Niobrara County						
1988	0	0	0	0	0	10
1990	0	20	20	40	50	100
1995	0	20	20	40	50	100
Platte County						
1988	0	20	20	40	50	80
1990	0	160	160	290	340	610
1995	0	160	160	290	340	610
Sheridan County[b]						
1988	0	60	880	1,150	920	1,760
1990	0	370	3,100	5,000	4,300	7,700
1995	0	370	1,430	3,300	4,300	6,000
Weston County						
1988	0	20	20	20	20	50
1990	0	100	100	180	160	370
1995	0	100	100	180	160	370

a. See footnotes to table 4-14 for derivation (except for Sheridan County).

b. See footnotes to table 4-15 for derivation.

(continued on next page)

INCREMENTAL POPULATION CHANGES (continued)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
Northern Powder River Region[c]						
Big Horn County						
1988	0	0	320	420	810	1,050
1990	0	0	940	1,110	1,600	2,340
1995	0	0	420	570	1,600	1,890
Powder River County						
1988	0	0	840	1,110	510	1,190
1990	0	0	2,870	3,500	1,480	3,600
1995	0	0	1,920	2,580	1,480	2,620
Rosebud County						
1988	0	0	680	1,030	880	1,540
1990	0	0	1,780	2,470	1,680	3,500
1995	0	0	1,070	1,760	1,680	2,750
The Crow Reservation[d]						
1988	0	0	160	210	410	530
1990	0	0	480	560	810	1,190
1995	0	0	210	290	810	960
The Northern Cheyenne Reservation[d]						
1988	0	0	150	190	180	380
1990	0	0	430	500	330	870
1995	0	0	220	260	330	640

[c] See footnotes to table 4-16 for derivation.

[d] See footnotes to table 4-17A for derivation.

Alternative 2

Soils, Vegetation, and Reclamation

A total of 355,700 acres would be disturbed under Alternative 2. This is 22,000 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 2 would consume 610 acre-feet of water per year more than that consumed under Alternative 1; however, most of this water could be supplied by rainfall on the mined areas and seepage into the pits. Under this alternative, 58 wells would be impaired or destroyed in addition to those impaired or destroyed under Alternative 1, and at least four additional springs would be impaired or destroyed. The destroyed wells could be replaced at approximately their original depth in the spoils aquifer after reclamation, but the quality of water would be poorer in most cases, with TDS typically 3,000 to 5,000 milligrams per liter (mg/l). This TDS range is unsuitable for human use and only marginally suitable for livestock use. Better quality water could be obtained at greater depth in most areas, but the static water levels in the deeper wells would be lower and pumping lifts would be greater.

Population increases associated with this alternative would require 990 acre-feet of water more than that required under Alternative 1. The impact of this requirement would be felt primarily by the communities of Wright and Gillette.

Surface Water

Under Alternative 2, surface outflow from the region would be reduced during mining by about 200 acre-feet per year (0.03%) in addition to the reduction under Alternative 1. The greatest effect would be in the Cheyenne River watershed, where flow would be reduced 0.9%.

About 55 livestock ponds and small reservoirs would be destroyed during mining. The quantity of water lost would not be significant, but the loss of point-watering sources would be a temporary deterrent to the use of the areas by wildlife and livestock.

The maximum potential increase in TDS concentrations in streams would range from 0.3% in the Tongue River to 2.3% in Armells Creek. However, these increases would have no significant impact on current uses of the water or on aquatic biology downstream and no measurable effect on the salinity of the Yellowstone River.

Land Use

New mine properties covering 20,200 acres would be added under Alternative 2. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

Nine landowners operate ranches within the boundaries of tracts included in this alternative. Two of them have voiced concern that development of the Kintz Creek tract would adversely affect air quality. They also expressed concern about noise impacts and access. Kintz Creek is also among the tracts selected for Alternatives 3, 4, 5, and 6.

Air Quality

Under Alternative 2, the Wyoming 24-hour standard would be violated around the Thundercloud and Kintz Creek tracts. (The Wyoming DEQ does not recognize the validity of the 24-hour prediction process.) Montana's 24-hour standards would be marginally violated near the North Decker I, North Decker II, and Spring Creek tracts. No federal air quality standards would be violated under any of the alternatives. The estimated increase in TSP emissions under Alternative 2 would be 5,227 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 2 would add 5 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 16 unit trains per day to the main lines leaving the region. The number of trains per day is shown on table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates. Most of the tracts in this alternative are maintenance tracts that would not add any new rail spur lines or additional trains.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

TABLE 2-3

ACREAGE OF LAND DISTURBED BY COAL MINING UNDER EACH ALTERNATIVE

	Total Acreage Disturbed[a]	Cropland Disturbed	Rangeland Disturbed	Acreage Disturbed Offsite[b]	Acreage Disturbed per Year	Total Acreage Disturbed at Any One Time[c]
Alternative 1 (Baseline)	293,900	No additional mining properties added.				
Alternative 2	20,160	3,040	17,120	1,900	740	6,300
Alternative 3	33,890	4,080	29,810	4,400	920	10,600
Alternative 4	51,480	5,040	46,440	6,100	1,540	15,400
Alternative 5	63,270	5,630	57,640	5,800	1,930	17,400
Alternative 6	101,070	8,410	92,660	10,100	2,850	27,100

NOTE: Figures are not cumulative.

a. Totals do not include off-site impacts.

b. Includes facilities, access roads, rail spurs, and urban growth.

c. Includes land mined and not yet reclaimed, facilities, off-site disturbance, and urban growth.

Alternative 3

Soils, Vegetation, and Reclamation

A total of 372,000 acres would be disturbed under Alternative 3. This is 38,300 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Annual water use for coal mining under Alternative 3 would be about 930 acre-feet greater than it would be under the "no action" alternative; however, most of the additional water could be supplied by rainfall on the mined areas and seepage into the pits. Municipal use would require 2,556 additional acre-feet per year.

About 93 more wells would be impaired or destroyed than under Alternative 1, and about 10 additional springs would be destroyed.

Surface Water

During peak production, surface outflow from the region would be reduced by 310 acre-feet per year more than under Alternative 1. Flow reductions would range from about 0.03% more in the Tongue River watershed to about 0.9% more in the Cheyenne River.

About 75 livestock ponds and small reservoirs would be destroyed during mining, causing a temporary deterrent to the use of the areas by wildlife and livestock.

The maximum potential increase in TDS concentrations above those under the "no action" alternative would range from 0.6% in the Belle Fourche River to 2.1% in the Tongue River and 2.3% in Armells Creek. These increases would have no significant impact.

Land Use

New mine properties covering 33,900 acres would be developed under Alternative 3. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 19 landowners (non energy-related operations) who operate within the boundaries of tracts included in this alternative. One landowner whose property adjoins the Mud Springs tract has expressed concern about impacts that development of this tract would have on the air quality of his operation. He also is concerned about noise and social impacts. The Mud Springs tract is also included in Alternatives 4 and 6. Also see the discussion of Kintz Creek under Alternative 2.

Air Quality

As under Alternative 2, the Wyoming 24-hour standard would be violated around the Thundercloud and Kintz Creek tracts, and marginal violations of Montana's 24-hour standards would be expected near the North Decker I, North Decker II, and Spring Creek tracts. The estimated increase in TSP emissions under Alternative 3 would be 7,427 tons per year more than under Alternative 1.

Interest has been expressed in a coal-fired power plant on the Mud Springs tract, which is included in Alternatives 3, 4, and 6. If the power plant was built on this tract, sulfur dioxide would be emitted at a constant rate of 10,381 tons per year and nitrogen dioxide at 20,696 tons per year through 2000.

The most restrictive regulation on sulfur dioxide is the prevention of significant deterioration (PSD) increment for the Northern Cheyenne Indian Reservation, a Class I area. The 24-hour allowable increment consumption for sulfur dioxide in a Class I area is 5 micrograms per cubic meter. The maximum increment consumption for sulfur dioxide is projected to be 2.1 micrograms per cubic meter at the reservation boundary.

Transportation Facilities

Alternative 3 would add 10 miles of rail spur to serve new facilities. Full production from these tracts would add 25 unit trains per day to the main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 4

Soils, Vegetation, and Reclamation

A total of 391,300 acres would be disturbed under Alternative 4. This is 57,600 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 4 would require 1,660 acre-feet of water per year more than that required by the "no action" alternative; however, most of the additional water would be supplied by rainfall on the mined areas and seepage into the pits. Associated population growth would require 3,844 acre-feet per year more than Alternative 1.

Approximately 109 more wells would be impaired or destroyed than under Alternative 1, and at least 10 additional springs would be destroyed.

Surface Water

Surface outflow from the region would be reduced by 555 acre-feet per year more than under Alternative 1. The flow reductions would range from about 0.04% more than Alternative 1 in the Tongue River watershed to about 1.0% more in the Belle Fourche River.

About 96 livestock ponds and small reservoirs would be destroyed during mining, causing a temporary deterrent to use of the areas by wildlife and livestock.

Maximum TDS increases over those under the "no new leasing" alternative would range from 0.76% in the Cheyenne River to 2.7% in the Tongue River.

Land Use

New mine properties covering 51,500 acres would be developed under Alternative 4. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 28 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternatives 2 and 3.

Air Quality

Wyoming 24-hour standards would be violated under Alternative 4 around the Thundercloud, Kintz Creek, and Mount Logan tracts. Marginal violations of Montana's 24-hour standards would occur near the North Decker I, North Decker II, and Spring Creek tracts. Power plant emissions from the projected plant on the Mud Springs tract would be the same as those described for Alternative 3. The estimated increase in TSP emissions under Alternative 4 would be 10,305 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 4 would add 10 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 44 unit trains per day to main lines leaving the region. The number of trains per day is shown on table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 5

Soils, Vegetation, and Reclamation

A total of 402,800 acres would be disturbed under Alternative 5. This is 69,100 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 5 would consume about 1,900 acre-feet of water per year more than would be required if there were no new leasing. Most of the additional water could be supplied by rainfall on the mined areas and seepage into the pits. Associated population growth would require 3,205 more acre-feet per year.

About 100 more wells would be impaired or destroyed by mining under this alternative than under Alternative 1, and at least 3 more springs would be destroyed.

Surface Water

Surface outflow from the region would be reduced by 635 acre-feet per year more than under Alternative 1. Flow reductions would range from 0.07% more than Alternative 1 in the Tongue River to about 1.0% more in the Belle Fourche River.

About 112 livestock ponds and small reservoirs would be destroyed during mining.

The maximum additional TDS increases caused by mining in Alternative 5 would range from 0.8% in the Cheyenne River to 2.9% in the Tongue River.

Land Use

New mine properties covering 63,300 acres would be developed under Alternative 5. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 37 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternative 2.

Air Quality

Violations of 24-hour air quality standards under Alternative 5 would be the same as those described for Alternative 4. The Mud Springs tract is not included in this alternative, so impacts described for the proposed power plant on that tract would not occur. The estimated increase in TSP emissions under Alternative 5 would be 12,489 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 5 would add 45 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 50 unit trains per day to main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interrruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 6

Soils, Vegetation, and Reclamation

A total of 444,800 acres would be disturbed under Alternative 6. This is 111,100 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining for this alternative would consume 3,250 acre-feet per year more than the "no new leasing" alternative. However, most of this water could be supplied by rainfall on the mine areas and seepage into the mine pits.

About 150 wells would be impaired or destroyed in addition to those impacted by projected mining under Alternative 1, and at least 24 more springs would be destroyed.

Population growth associated with the coal development would require an additional 5,900 acre-feet per year for municipal supplies.

Surface Water

It is estimated that the reduction in regional surface outflow would exceed that of the "no action" alternative by 1,085 acre-feet per year. The greatest flow reductions would be in the Little Powder River watershed, which would have a decrease in flow of about 1.6%.

About 179 livestock ponds and small reservoirs would be destroyed during mining. The loss of these point-watering sources would be a temporary deterrent to use of the areas by wildlife and livestock until the water sources were replaced after reclamation.

The estimated maximum additional increases in TDS concentrations would range from 1.3% in the Cheyenne River to 5.8% in the Tongue River.

Land Use

New mine properties covering 101,100 acres would be developed under Alternative 6. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 52 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternatives 2 and 3.

Air Quality

Under Alternative 6, the Calf Creek tract in Wyoming and the Downey Coulee tract in Montana would be added to the list of tracts that would violate the 24-hour standards, as described under Alternative 4. Impacts from the proposed coal-fired generator on the Mud Springs tract would be as described under Alternative 3. The estimated increase in TSP emissions under Alternative 6 would be 19,275 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 6 would add 65 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 85 unit trains per day to main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

CHAPTER 3: THE AFFECTED ENVIRONMENT

INTRODUCTION

Components of the environment described in this chapter are those that would be affected by one or more of the alternatives. Climate, physiographic provinces, geologic structure, floodplains, threatened and endangered plant species, prime farmlands, wilderness or wilderness study areas, recreation, areas of critical environmental concern, and wild and scenic rivers are not discussed either because they do not occur in the region or because they would not be significantly affected by any of the alternatives.

Certain areas in some Wyoming and Montana tracts have been preliminarily identified as alluvial valley floors (AVFs), and one area in Montana has been definitely identified as an AVF. The possible AVFs have been excluded from consideration for leasing; however, before approval of a mining permit for a tract, the OSM or the appropriate state agency would make a final determination as to their existence and as to whether mining would be permitted in that part of the tract. The location and status of each possible AVF is detailed in appendix C.

GEOLOGY AND MINERALS

Coal

The economic coal beds of the region are found principally in the Tongue River Member of the Paleocene Fort Union Formation and in the Eocene Wasatch Formation. These coal beds generally are 30 to 70 feet thick and cover a wide area (more than 2,700 square miles).

The quality of coal is good, with the Btu content ranging from 8,000 to 9,300 Btus per pound and sulfur content less than 0.5% (see appendix A). Quantities of strippable reserves are estimated to exceed 100 billion tons. The coal seams of greatest significance are the Wyodak, Anderson, Dietz, Knobloch, and Canyon.

Detailed discussions concerning the quality, quantity, correlation, and locations of the coal beds appear in the individual tract profiles, and in *Draft Environmental Statement: Regional Analysis: Northern Powder River Basin Coal, Montana* (USDI, GS & Mont. DSL 1979) and *Final Environmental Statement: Proposed Development of Coal Resources in Eastern Powder River, Wyoming* (USDI, BLM 1979b). This information also is available in *Wyoming Geological Association 28th Annual Field Conference Guidebook* (Glass 1976), *Quality and Reserves of Strippable Coal, Selected Deposits: Southeastern Montana* (Mon, Bur, Mines & Geol. 1973), *Montana Coal: A Guide to Coal Geology, Resources, and Production* (Mont. Bur. Mines & Geol. 1980), and *Geology of the Tongue River Member, Fort Union Formation, Eastern Montana* (Matson and Pinchock 1977).

Coal areas in the Powder River Basin generally have suffered little structural deformation. Significant faults and folds are rare; they are confined mostly to the west flank of the basin along the Big Horn Mountains. This region is classified as aseismic; that is, having no tendency for earthquakes (Simon 1972).

Abundant plant and invertebrate fossils are found in the Tertiary coal-bearing rocks. Vertebrates and other significant fossils are rare; few have been found. The fossils known to be in the region have no exceptional scientific interest or value (USDI, BLM 1979b; USDI, GS & Mont. DSL 1979).

Other Minerals

Other minerals of economic importance in the region are oil and gas, uranium, and bentonite. The primary mineral resource in the region is oil and gas. Oil production in 1980 exceeded 45 million barrels. The uranium industry was very prominent in the southern part of the region before the Three-Mile Island incident. It is now dormant, with most mines closed or producing only small amounts of ore. Bentonite production in the region has declined with the recession and the decline of oil and gas exploration.

Further information is available in the publications cited under "Coal," above.

SOILS AND RECLAMATION

Soils in the region can be grouped into three general types. The first, and most extensive, are the recent soils, which are classified in the Entisol soil order. They occur mostly on sloping topography where geologic erosion is too high to permit profile development or accumulation of organic matter. The physical and chemical properties of these soils are reliant upon those of the parent materials from which they are derived. These soils are relatively low in plant nutrients and commonly have textures that are too high in clay to be highly suitable for reclamation.

The region also has extensive areas of upland soils on flatter, more stable topography. They are classified in the Aridisol soil order. They commonly have low to moderate accumulations of organic matter and plant nutrients in the surface layer. They also have moderate to strong structural development within the solum (topsoil, subsoil, and soil-like parent material), which is important for good moisture intake and gas exchange within the soil. Stronger profile development also means that carbonates and salts present in the parent material have been leached by water to depths of 1 or 2 feet, or more. This produces a more fertile rooting zone. These soils are the most extensive (in terms of acreage) source of surface material suitable for plant growth when the textures are loamy; that is, not too clayey or sandy. Clayey soils tend to be impermeable to water and therefore droughty. Aridisols are less suitable than mollisols for surface reclamation.

The third major soil type is the Mollisols, which are the most fertile upland soils. These soils are of minor extent in the Wyoming part of the region, but they comprise significant acreage in Montana. They have surface layers high in organic matter and nutrients, and they are the best source of surface soil for rehabilitating the disturbed landscape.

There are minor amounts of fluvial soil types, which are found in flat to gently sloping drainage bottoms. Fluvial soils vary considerably in fertility, depending on the source of the alluvium; however, where salt concentrations are low these soils tend to be very fertile and are the most productive in the region. Riparian areas associated with these soils are especially important because they are a crucial source of biological diversity.

Riparian areas with their specific soils are scarce in the Powder River Region (USDI, GS & Mont. DSL 1979). Minor amounts of other soils are found in the region, including soils with some profile development that are found mainly in recent alluvial landscapes. The fertility of these soils is similar to that of the Entisols.

Detailed descriptions of the soils by tract are included in the individual tract profiles for the Montana tracts. Soil information for the Montana tracts in Big Horn County has a high reliability, since it comes from an Order II soil survey by the Soil Conservation Service, U.S. Department of Agriculture (SCS). According to the Miles City District of the BLM, the soil information for tracts in Powder River County is estimated to have a 30% reliability. A new survey publication for this county is planned.

Soil information for the Wyoming tracts is based on the *Wyoming General Soil Map* (U. of Wy. Ag. Exp. Sta. 1977). This map consists of large delineations of soil associations, some larger than the tracts themselves, so there is no way to determine from the map what percentage of each component is present in a tract or whether any given component occurs within the tract. Therefore, the *General Soil Map* has no utility for making predictions about the fertility of the soils on the Wyoming tracts or their reclamation potential. More site-specific information on soils may be available for Wyoming tracts in the near future.

Reclamation efforts at mines in the region indicate that most soils in the region have a fairly good reclamation potential. "Fairly good" means that these soils rate 7 on a scale of 1 to 10. Reclamation potential is assessed further in the individual tract profiles, in a Forest Service publication (USDA, FS 1974b), and in table 4-1 in chapter 4.

VEGETATION

The major vegetation type in the Wyoming part of the region is the sagebrush-herbaceous, which may also be called sagebrush-grassland. Sagebrush cover of this type generally varies from 20% to 60%. The major grasses are western wheatgrass, needle-and-thread grass, bluegrass, and prairie junegrass. Also of major extent in the Wyoming part of the region is the grassland-mixed shrub type, in which the major overstory species are snowberry, skunkbush sumac, wild currant, and big sagebrush. The major understory species are bluebunch wheatgrass, little bluestem, and Indian ricegrass. The Eastern Powder River coal EIS (USDI, BLM 1979b) contains a more detailed description of the major vegetative types in the Wyoming portion of the Powder River Coal Region.

There are lesser acreages of the juniper-mixed shrub type, in which the major species are Rocky Mountain juniper, big sagebrush, skunkbush sumac, snowberry, and bluebunch wheatgrass. The riparian type, although it constitutes only a small percentage of the total acreage, is of major importance for wildlife habitat. The major species in this type are cottonwood, boxelder, willow, big sagebrush, western wheatgrass, and bluegrass. More detailed descriptions of the vegetation are included in the individual tract profiles.

The major vegetation types in Montana are the ponderosa pine-grass type, the sagebrush-grass type, the native grassland, and the riparian type. The ponderosa pine type generally is found on shallow, rocky soils. Sagebrush-grass and native grassland types are found on sites that vary from steep slopes to flat areas and have sandy to clayey texture. The fertility of the soils on these sites also can vary considerably. The riparian type, which is found in flat drainage bottoms, produces the most vegetation, but it accounts for only a small part of the total acreage. The 1979 Northern Powder River EIS (USDI, GS & Mont. DSL 1979) contains a more detailed description of the major vegetation types. Table 3A shows the acreage of vegetation types in the coal tracts proposed for leasing.

WATER RESOURCES

Surface Water

The region is drained to the north by Rosebud Creek, the Tongue River, and the Powder River and to the east by the Belle Fourche and Cheyenne rivers. Tributaries of these streams are generally ephemeral or intermittent.

There are two peak runoff periods during the year, corresponding to late winter snowmelt and spring rainfall. The lowest streamflow occurs from October through January. The streamflow regime is modified by numerous small reservoirs (mostly less than 20 acre-feet) and spreader systems. These structures result in appreciable depletion of runoff through increased seepage and evapotranspiration. Very high peak flows (floods with a return interval of 50 years or more) are not noticeably reduced by these structures (USDI, BLM 1979b).

Yields from the nonmountainous drainage basins (the Belle Fourche, Cheyenne, and south and east parts of the Powder River watershed) are generally less than 0.05 cubic feet per second per square mile (cfsm). Streams draining the Big Horn Mountains in the western part of the area generally yield more than 0.3 cfsm (USDI, GS 1973). Volumes of runoff vary considerably from year to year.

Erosion is quite high during peak flows in the ephemeral streams of the region. Sediment yields typically range from 0.13 to 1.3 acre-feet per

TABLE 3A
ACREAGE OF VEGETATIVE TYPES IN COAL LEASE AREA
BY ALTERNATIVE

Alternative	Total	Sage/ Grass	Grassland	Ponderosa Pine	Other[a]
1	293,900	(data breakdown is not available for baseline acreage)			
2	14,128	8,626	3,670	0	1,832
3	26,888	10,436	7,729	2,788	5,935
4	40,445	20,613	9,008	3,292	7,532
5	60,234	34,825	12,398	3,482	9,529
6	87,064	50,905	19,806	3,482	12,871

NOTE: This table lists only the acreage of vegetative types on the proposed coal tracts. Off-site acreage is shown in table 2-3.

[a] One or more of the following types: saline upland, saline lowland, mixed shrub-herbaceous, riparian deciduous.

square mile per year (USDI, BLM 1979b).

The chemical quality of water in the streams of the region changes continually with varying amounts and sources of water. In streams in the central and eastern parts of the Powder River basin, calcium, sodium, and sulfate are the dominant ions. TDS concentrations frequently are higher than 2,000 mg/l. Streams originating in the Big Horn Mountains, including the Tongue River and Rosebud Creek, typically have much better water quality. Water generally is of the calcium-bicarbonate type, and TDS concentrations often are less than 500 mg/l.

The largest use of surface water is for irrigation along stream valleys. Because stream discharge is small during the irrigation season, small reservoirs are often used for storage of irrigation supplies. Perennial streams and small reservoirs are also important sources of livestock water. Surface waters are used as municipal supplies for Sheridan, Buffalo, Dayton, Ranchester and Kaycee.

Groundwater

Aquifers in the Powder River Basin are contained in formations with a total thickness of more than 9,000 feet. The deepest aquifer of major importance is the Madison aquifer, which is found in the Big Horn Dolomite and Madison Limestone. These formations consist of dense Mississippian carbonate with low primary permeability. High secondary permeability exists locally in areas where there has been fracturing or solution. Yields of more than 1,000 gallons per minute (gpm) are possible where cavernous or fractured zones are present. Transmissivities are typically from 0.010 to 0.025 square feet per day. Recharge into the Madison occurs in the Big Horn Mountains, the Black Hills, the north end of the Laramie Mountains, and the Hartville Uplift. TDS concentrations usually are less than 1,000 mg/l. The major ions are calcium, magnesium, carbonate, and sulfate. The best quality water is found near outcrop areas, where TDS is typically less than 300 mg/l and sulfate less than 10 mg/l.

Most wells in the Madison aquifer are near outcrop areas. In the Black Hills, production exceeds 10,000 acre-feet per year. Bell Creek, Montana, Osage and Newcastle, Wyoming, and Edgemont, South Dakota, obtain water from Madison wells. Douglas, Wyoming, obtains Madison water from a spring. In the Midwest oil fields in Wyoming, wells about 5,000 feet deep supply water for water-flood secondary recovery operations.

The shallow aquifers are separated from the underlying Madison group by a sequence of Cretaceous shales up to 5,500 feet thick.

The Fox Hills-Lance aquifer (referred to as the Lower Hell Creek-Fox Hills in Montana) underlies the strippable coal in much of theregion. It is nearest the surface and most continuous in the northern part of the Powder River basin. The aquifer consists of Upper Cretaceous sands interbedded with sandy shale and claystone. The thickness of water-bearing zones ranges up to about 750 feet. Yields of 100 to 200 gpm are possible in the northern part of the basin. TDS concentrations range from 200 to 2,000 mg/l. No dominant water type is prevalent (Koch et al. 1982).

The Tullock aquifer consists of a section of the Tullock Member of the Fort Union Formation up to 600 feet thick plus the upper 10 to 80 feet of the Lance Formation. It is fine-grained sand, jointed coal, and clinker interbedded with shale. Yields are typically 15 to 40 gpm.

The Lebo Shale overlies the Tullock member and separates it from the Tongue River Member of the Fort Union Formation. In the Tongue River Member, thick coals and thick sandstone lenses beneath the coals are the principal water producers.

The Wasatch Formation, which overlies the Fort Union Formation, yields water sufficient for livestock consumption and domestic purposes from wells completed in lenticular sandstones, and to a lesser extent in jointed coal and clinker beds. Wells in the northern part of the basin may produce 10 to 50 gpm; wells in the southern part produce more. TDS concentrations range from 200 to 8,000 mg/l, but typically they are from 500 to 1,500 mg/l. Better quality water is found in the southern part of the basin. Sodium sulfate and sodium bicarbonate are the dominant water types.

Recharge to the shallow aquifer system is mainly in upland areas through sandy zones of the Fort Union Formation, coarse-grained alluvium, and clinker.

Quaternary alluvium contains the shallowest aquifers in unconsolidated silt, sand, and gravel deposits underlying floodplains and alluvial terraces. The thickness of the alluvial deposits is generally less than 50 feet, but it may be more than 100 feet in some valleys near mountains.

Yields range from a few gallons per minute to several hundred gpm in coarse-grained material along perennial rivers. TDS concentrations range from about 100 to more than 4,000 mg/l, but typically they are between 500 and 1,500 mg/l. Water in alluvium near the Big Horn Mountains and the Black Hills is usually better than that in the central part of the basin. No dominant water type is prevalent.

LAND USE

Agriculture is the primary land use in the region, occupying 87% of the land (Mont. Crop & Lvst. 1980; Wyo. Crop & Lvst. 1981). Most of the agricultural land is used for cattle and sheep. Most farming is dryland production of grain or hay. There is some flood-irrigated farming along stream bottoms.

There are no prime farmlands or wetlands in the region (USDA, SCS 1981). Land uses related to energy development accounted for 23,500 acres in the Montana portion of this region and 76,500 acres in the Wyoming portion of the region in 1980.

Land use in the region has previously been described in the 1979 Northern Powder River EIS, the 1979 Eastern Powder River EIS, and the 1981 Wyoming Coal EIS (USDI, GS & Mont. DSL 1979; USDI, BLM 1979b, 1981b). Refer to table 2-3 and the individual tract profiles for tabulations of affected land by type.

WILDLIFE

Wyoming

The area in the Powder River Basin most affected by coal mining is the Highlight antelope herd unit (hunt areas 24 and 101). Most of the factors that affect this herd unit remain unchanged from those described in the final coal EIS prepared in 1981 (USDI, BLM 1981b). Table 3-1 shows the harvest figures for recent years in antelope and mule deer hunt areas. Table 3-2 shows the acreage that probably would be disturbed by coal mining projects underway or planned. The antelope hunt district/area map shows the locations of hunt areas.

The antelope population in the Highlight herd unit has greatly increased since 1980 to its present level of approximately 12,800 animals, or 10.9 per square mile. Three main factors have contributed to this population explosion: First, all of Campbell County is a favored area for out-of-state hunters; however, the nonresident hunting license fee was drastically increased in 1980, and the number of licenses sold since then has declined sharply. Second, high trespass fees charged for hunting on private land also have discouraged hunters who have already paid a substantial sum for a hunting license. Third, three consecutive mild winters have greatly reduced antelope deaths from winter stress. In addition to these factors, most land that is now leased for coal development—about 7.6% of this herd unit—is closed to sport hunting.

There currently are two mines in antelope hunt area 17 (Gillette herd unit). There is some seasonal movement of antelope in the portion of the herd unit north of Spotted Horse west to the Powder River. A large portion of this herd moves southeast in the late fall into the sagebrush grasslands between Rawhide Creek on the south and Horse Creek on the north. Antelope are common only in the benches and bottomlands along Wild Horse Creek.

Investigations conducted by the Wyoming Game and Fish Department in northern Campbell County showed no significant winter mule deer concentration areas in deer hunt areas 17 and 18. High use areas are described in the 1981 Coal EIS (USDI, BLM 1981b).

Sage grouse are the most common upland game bird in Campbell County, where 51 leks are known to exist. Sixteen of these leks are in the area southeast of Gillette (antelope hunt areas 24 and 101). Five leks have been abandoned and two others destroyed by coal mining activities since 1975 (Wyo. Game & Fish 1979). These are active sage grouse leks on the Mount Logan and Hay Creek tracts.

Sharp-tailed grouse are common in the northern half of Campbell County, with eight leks known. Data are not available for the rest of the county.

There are several migratory bird species of high federal interest in the Powder River Region. These species receive special attention under federal coal leasing regulations. The species in the Wyoming part of the region most likely to be affected by development are golden eagle, prairie falcon, ferruginous hawk, merlin, burrowing owl, mountain plover, and Lewis' woodpecker. Less likely to occur in the Wyoming portion are the

TABLE 3-1
ANTELOPE AND DEER HARVEST IN WYOMING

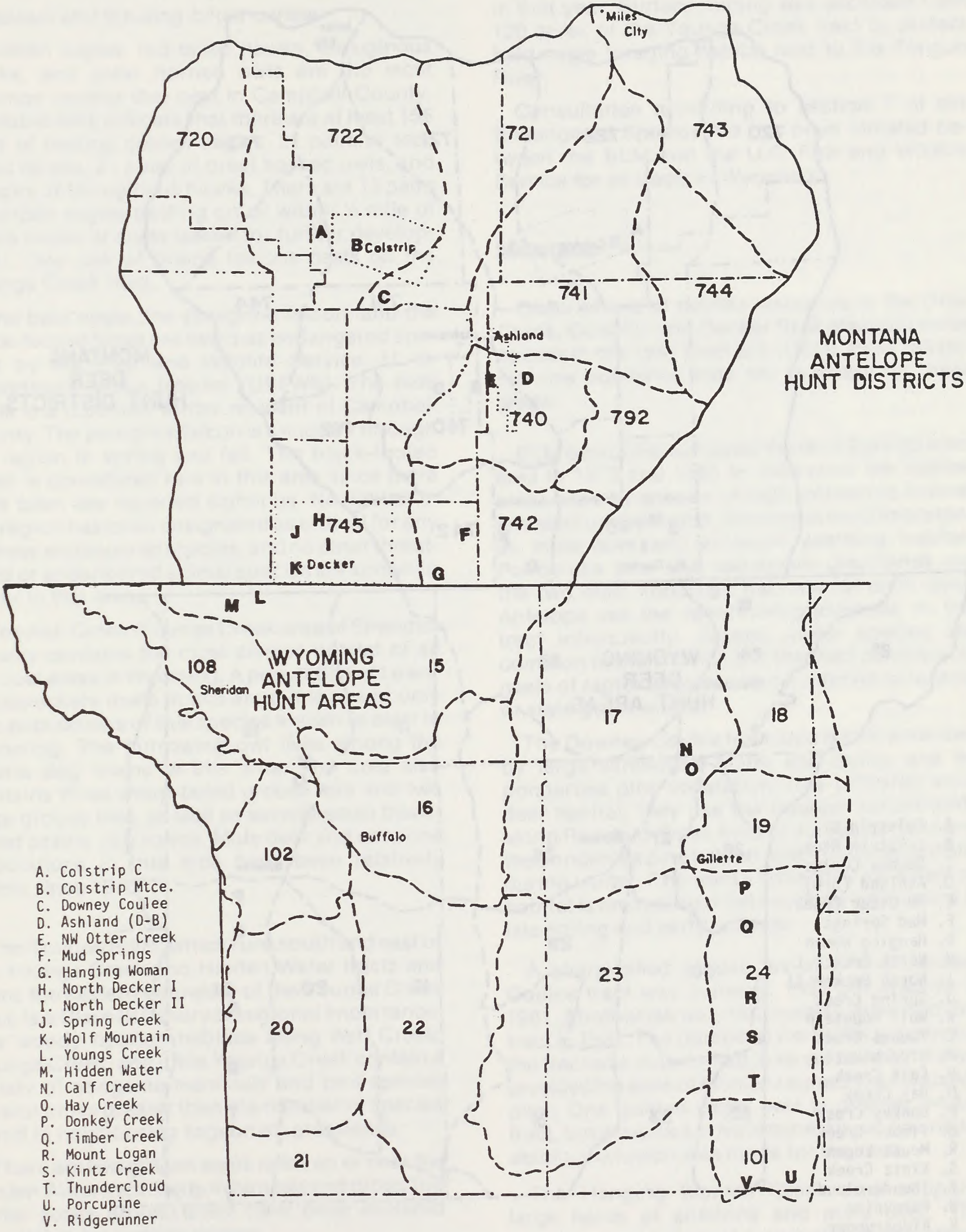
Year	Harvest and Percentage of Change from Previous Year					
	Antelope Hunt Area			Mule Deer Hunt Area		
	24[a]	17	15	21	18	24
1976	2,545	2,983	562	878	2,178	714
1977	1,937 - 23.9%	1,176 - 43.5%	515 - 8.4%	736 - 16.2%	1,876 - 13.9%	1,654 + 131.6%
1978	1,893 - 2.37%	1,627 - 5.2%	575 + 11.6%	498 - 22.3%	1,069 - 43.1%	1,008 - 39.1%
1979	1,226 - 35.3%	1,071 - 34.2%	610 + 6.1%	316 - 36.6%	749 - 30.0%	1,007 0
1980	501 - 59.2%	470 - 56.2%	516 - 15.5%	361 + 14.2%	1,017 + 35.8%	984 - 2.3%
1981	887 + 77.0%	638 + 35.7%	832 + 61.2%	414 + 14.7%	897 - 11.8%	1,180 + 19.9%
1982	1,244 + 40.2%	815 + 27.7%	532 - 36.1%	409 - 1.2%	1,301 + 45.0%	1,363 + 15.5%

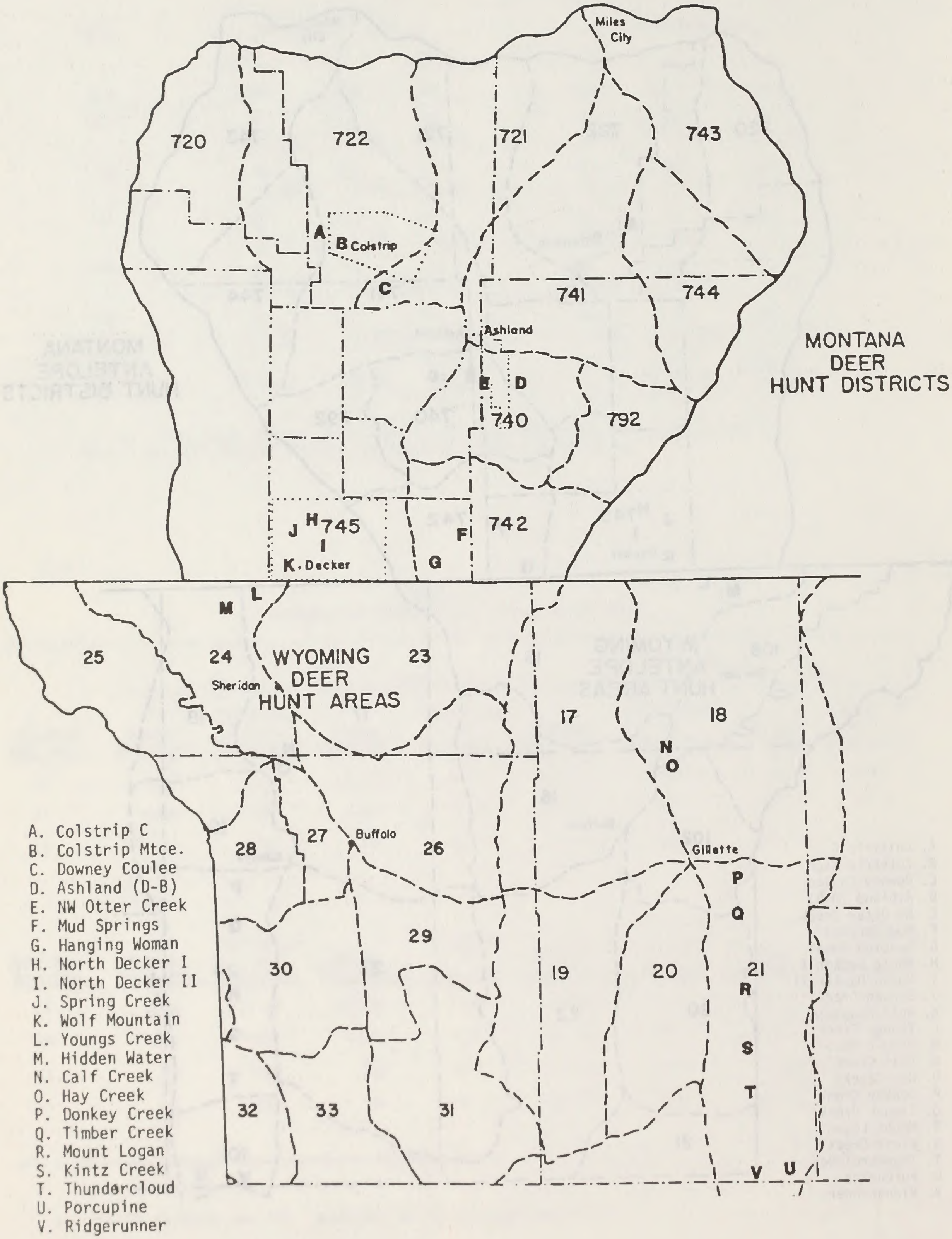
a. Area 24 was divided into areas 24 and 101 in 1979. The figures given here for area 24 for 1979 through 1982 are the combined figures for both areas.

TABLE 3-2
ACREAGE DISTURBED BY COAL MINING IN HUNT AREAS

	1983		1985		1990		1995	
Antelope Hunt Area	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit
24[a]	8,933	1.2%	12,333	1.6%	22,444	3.0%	31,946	4.2%
17	3,142	0.3%	4,264	0.4%	10,152	0.9%	23,297	2.1%
15	746	0.1%	822	0.1%	2,572	0.3%	8,512	1.1%
Mule Deer Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area
21	8,933	1.2%	12,333	1.6%	22,444	3.0%	31,946	4.2%
18	3,142	0.3%	4,264	0.4%	8,394	0.8%	13,767	1.4%
24	746	0.2%	822	0.2%	1,440	0.4%	2,184	0.6%
17	-0-	-0-	-0-	-0-	1,758	0.2%	9,530	1.2%

a. Area 24 includes area 101. Both make up the Highlight Herd Unit.

Miles City
720
722
721
743
A
B Colstrip
C
741
744
Ashland
MONTANA
ANTELOPE
HUNT DISTRICTS
E
D
740
792
J
H
745
I
F
742
K
Decker
G
M
L
WYOMING
ANTELOPE
HUNT AREAS
108
Sheridan
15
17
18
N
O
16
Buffalo
102
19
Gillette
P
Q
23
24
R
20
22
S
T
21
101
V
U
A. Colstrip C
B. Colstrip Mtce.
C. Downey Coulee
D. Ashland (D-B)
E. NW Otter Creek
F. Mud Springs
G. Hanging Woman
H. North Decker I
I. North Decker II
J. Spring Creek
K. Wolf Mountain
L. Youngs Creek
M. Hidden Water
N. Calf Creek
O. Hay Creek
P. Donkey Creek
Q. Timber Creek
R. Mount Logan
S. Kintz Creek
T. Thundercloud
U. Porcupine
V. Ridgerunner



A. Colstrip C
B. Colstrip Mtce.
C. Downey Coulee
D. Ashland (D-B)
E. NW Otter Creek
F. Mud Springs
G. Hanging Woman
H. North Decker I
I. North Decker II
J. Spring Creek
K. Wolf Mountain
L. Youngs Creek
M. Hidden Water
N. Calf Creek
O. Hay Creek
P. Donkey Creek
Q. Timber Creek
R. Mount Logan
S. Kintz Creek
T. Thundercloud
U. Porcupine
V. Ridgerunner

dickcissel and the long-billed curlew.

Golden eagles, red-tailed hawks, ferruginous hawks, and great horned owls are the most common raptors that nest in Campbell County. Available data indicate that there are at least 155 pairs of nesting golden eagles, 21 pairs of red-tailed hawks, 21 pairs of great horned owls, and 79 pairs of ferruginous hawks. There are 13 pairs of golden eagles nesting on or within ½ mile of active mines or areas leased for further development. One pair of prairie falcons nests on the Youngs Creek tract.

The bald eagle, the peregrine falcon, and the black-footed ferret are listed as endangered species by the Fish and Wildlife Service, U. S. Department of the Interior (USFWS). The bald eagle is a common winter resident of Campbell County. The peregrine falcon is a migrant through the region in spring and fall. The black-footed ferret is considered rare in this area since there have been few reported sightings. No habitat in the region has been designated as critical for any of these endangered species, and no other threatened or endangered animal species are known to occur in this area.

The Ash Creek-Youngs Creek area of Sheridan County contains the most diverse habitat of all the coal areas in Wyoming. A population of Lewis' woodpeckers nests in this area. It is one of only two populations of this species known to exist in Wyoming. The burrowing owl lives among the prairie dog towns in this area. The area also contains three sharp-tailed grouse leks and two sage grouse leks, as well as several small black-tailed prairie dog towns. Mule deer and antelope populations in this area have been relatively stable since 1976.

The Tongue River, which runs south and east of the Youngs Creek and Hidden Water tracts and forms the eastern boundary of the Youngs Creek tract, is a Class III fishery of regional importance. The woody riparian habitats along Ash Creek, Youngs Creek, and Little Youngs Creek contain a variety of nongame mammals and bird species several times greater than the number of species found in neighboring sagebrush grasslands.

There are two golden eagle nests on or near the Hidden Water tract. Both of the nests and protective buffer zones around them have been declared unsuitable for surface mining.

A bald eagle nest was discovered in 1983 approximately 1 mile from the Youngs Creek tract, and two young were fledged from the nest in that year. Surface mining was excluded from 120 acres of the Youngs Creek tract to protect bald eagle foraging habitat next to the Tongue River.

Consultation according to section 7 of the Endangered Species Act has been initiated between the BLM and the U.S. Fish and Wildlife Service for all tracts in Wyoming.

Montana

Descriptions of wildlife resources in the Otter Creek, Colstrip, and Decker BLM planning areas appear in the 1981 Coal EIS (USDI, BLM 1981b). No new published data are available for these areas.

BLM personnel surveyed the Mud Springs tract area in 1979 and 1980 to determine the habitat areas used by species of high interest to federal and state governments. The area is most important as mule deer and antelope yearlong habitat. Ponderosa pine and sagebrush grasslands are the two most important habitats for mule deer. Antelope use the sagebrush-grasslands on the tract infrequently. Several raptor species are common in the vicinity, but the tract contains no nests of raptor species of high interest to federal or state government.

The Downey Coulee tract area is characterized by large sandstone bluffs and buttes and by ponderosa pine vegetation. It is primarily mule deer habitat; they use the riparian bottomlands along Rosebud Creek heavily during summer and the ponderosa pine habitat year-round, especially during winter. The tract's suitability for antelope habitat is limited, so most antelope use occurs in late spring and early summer.

A sharp-tailed grouse lek in in the Downey Coulee tract was active in 1980 but inactive in 1981. Another lek was discovered just north of the tract in 1981. The portion of the buffer zone inside the tract was determined to be suitable for mining provided the state of Montana agrees to a mitigation plan. One golden eagle nest is present on the tract, but it overlies private minerals, so no unsuitablility exclusion was made for the nest.

The Hanging Woman Creek area supports large herds of antelope and mule deer. The largest concentration of deer in all seasons occurs in the hills between the East Fork of Trail Creek and Horse Creek (Martin 1980). Antelope also tend to concentrate on the mid-slope areas north of Trail Creek, especially in winter (Martin 1980).

Three sharp-tailed grouse leks are known in the area. One lek is approximately 600 yards west of the Hanging Woman tract. An area surrounding this lek on the Hanging Woman Creek bottom has been declared unsuitable for mining. The tract also contains two sage grouse leks, and one other sage grouse lek is less than ½ mile from the boundary. The corporation that owns deeded lands on and around the tract and the Montana Department of Fish, Wildlife, and Parks have agreed to a mitigation plan setting aside areas of sagebrush habitat outside the tract for use by grouse.

Several small black-tailed prairie dog towns are on the Hanging Woman Creek tract. The towns were searched for black-footed ferrets in 1980, but no sign of this endangered species was found. Several raptor species of high federal interest nest near the tract, but none are known to nest on the tract.

Consultation according to section 7 of the Endangered Species Act has been initiated between the BLM and the U.S. Fish and Wildlife Service for all tracts in Montana.

CULTURAL RESOURCES

Background

The Powder River region of the Great Plains has witnessed human activity for the past 12,000 years. As a result of this occupation, approximately 8,000 prehistoric and historic sites are known to exist. These cultural resourcesrange from prehistoric hunters' camps to bison kill sites, stone circles, quarries, petroglyphs and pictographs, burials, pottery sites, rock shelters, lithic scatters, and stratified sites caused by continued reuse of a certain area.

In addition, the district also contains ethnohistoric and historic cultural resources. The Indian utilization of a region subsequent to European contact represents the ethnohistorical period; the historic period is the period during which Euorpean-American exploration and settlement occurred. Site types from these periods include trails, battlefields, homesteads, historic mines, and native American religious sites.

In recent years cultural resource inventories have been conducted as a response to increasing energy development. These inventories are undertaken in compliance with Section 106 of the National Historic Preservation Act and Section 2(b) of Executive Order 11593.

However, at present only approximately 4% of the Powder River Basin region has been surveyed for cultural resources at a Class III level. Although two major Class II projects have been completed, "The Western Powder River Basin Survey" (Reher n.d.) and "The Eastern Powder River Basin Survey" (Metcalf-Zier 1981), neither of these two complies with current mine permit stipulations requiring intensive inventory for cultural sites. A Class II study is a 10% sample survey of a selected area. Consequently, though large areas have been surveyed at a Class I literature search level and a Class II sample survey level, these inventories are not of sufficient intensity to "clear" areas for coal mining purposes.

Prehistory

The prehistoric chronology for this region is based largely upon studies completed in neighboring areas. The first chronology for the Powder River Region was developed by Mulloy in 1958 and later revised by Frison in 1978. According to thses studies, the Paleo-Indian period extends from 11,200 to 7,500 years ago; the Early Plains archaic from 7,500 to 5,000 B.P.; the Middle Plains Archaic from 5,000 to 3,000 B.P.; Late Plains Archaic from 3,000 to 1,700 B.P., and the Late Prehistoric from 1,700 to 300 years ago.

Until more research is conducted, the actual significance of sites falling into these different periods is difficult to evaluate. Though archeological investigations have provided enough fundamental information to venture a few suggestions concerning settlement pattern and subsistence strategies, these assumptions are based on limited data. However, generally the greatest site density should occur in areas of highest topographic diversity. Such areas gave prehistoric peoples the ability to exploit the variety of wildlife and plant species that occurred in different ecological zones. The lowest site density, then, should be in large, flat open areas.

Because the number of extensive excavations in the Powder River Region has been small, no particular site type or time period can be evaluated as more significant than another. Any site that has the ability to contribute new information to our understanding of prehistoric lifeways is significant.

Ethnohistory and History

Ethnography and ethnohistory allow some delineation of tribal movements from about A.D. 1400 to the present. Tribal demography can be seen as a series of population relocations. Between 1400 and 1850 A.D. the Powder River Basin was shared by the Crow, Plains Apache, Shoshoni, Comanche, Cheyenne, Teton Dakota, and Arapahoe.

The first known historic travelers to reach this region were members of Francois Antoine Larocque's Northwest Company. Then in 1811 and 1812 the Astorians from the American Fur Company crossed the divide between the Powder River and the Little Missouri River. Various groups of trappers, traders, missionaries and military men traversed the basin between 1820 and 1860. Emigrant traffic began in 1863 to proceed up the Powder River trail pioneered by John Bozeman and John Jacobs. Because this route violated the last sacred hunting grounds of the regional Native Americans, the trail was the scene of numerous Indian-military and Indian-emigrant conflicts. By 1864 the route was known as the "Bloody Bozeman."

With the end of the Civil War, the government began concentrating its military efforts on subduing the hostile Plains tribes. Notable events occurred along the Bozeman Trail at Crazy Woman Creek, at Fort Phil Kearny, and the Little Big Horn. Both the Fetterman Massacre in 1866 and the Custer Massacre in 1876 were desperate attempts on the part of Powder River tribes to fight off the growing encroachment of whites in their treaty-assured lands. All efforts failed. By the end of the 1870s, the Plains Indian peoples were confined on reservations.

After 1880 homesteaders began settling the region, forming small farms and ranches. Later large cattle companies started competing with the small operations, and conflicts over who had right to the use of open public land resulted in the Johnson County War of 1892.

The railroad reached Gillette, Campbell County, in 1891, and homesteading efforts were stepped up accordingly. Sheep were introduced and energy production pursuits began.

Early coal mines and oil and gas activities were initiated as early as 1882. Large scale oil development began in the 1950s and coal development in the 1970s.

Physical evidence of early homesteading and energy production is present throughout the region.

The Northern Cheyenne Tribe has indicated that there are two religious sites on the Downey Coulee tract. The tribe has been asked to identify the location of the sites, but to date the BLM has received no further information.

Specific numbers of sites in each tract are reported in the individual tract profiles. More extensive discussion of prehistoric and historic activities in the region is included in the 1979 Eastern Powder River coal EIS (USDI, BLM 1979b) and the 1979 Northern Powder River Coal EIS (USDI, GS & Mont. DSL 1979).

VISUAL RESOURCES

The landscape in areas that would be affected in the Montana portion of the region is mostly rolling uplands dissected by steep-sided valleys. Areas of rugged hills and badlands also would be affected. The affected landscape in the Wyoming portion is largely low rolling hills and flat plains. There are rough hills and breaks along the Powder River. The dominant visual element in both the Montana and Wyoming portions of the region is the Big Horn Mountains in the west.

The scenic quality of most of the lands is rated Class B or Class C according to the BLM's visual resource management (VRM) system (USDI, BLM 1980c). These quality ratings, when combined with sensitivity levels and distance zones, form visual management classes. Scenic quality B and C, combined with medium sensitivity and foreground/middleground and background zones, result in management classes of III and IV.

The landscape character of Forest Service lands in the region is generally rated Subtype 6. Variety classes generally are C, with some Class B or Class A areas. Visual quality objectives for these lands range from partial retention through modification to maximum modification. The land classification systems of the Forest Service and the BLM are described in appendix D.

More detailed descriptions of the region's visual resources are available in the Eastern Powder River EIS, the 1981 coal EIS, and the Montana coal EIS (USDI, BLM 1979b, 1981b; USDI, GS & Mont. DSL 1979).

NOISE

Noise levels in rural areas of the region are low (30 to 50 dBA), with most noise sources related to agriculture. The major noise impacts from energy development are related to transportation. Increased vehicular and train traffic has increased noise impact zones along major transportation routes. The major receptors of noise effects are the residents of Miles City, Colstrip, and Forsyth, Montana, and Gillette, Newcastle, Torrington, and Lusk, Wyoming. Noise dissipates rapidly in wide-open rural areas; thus, the effects of mines on rural areas are not as great as those on residential areas within 1 mile of a mine. However, surveys have shown that residents in subdivisions within 1 mile of existing mines in this region have few problems with noise from coal mining (Paul Nelson Asso. 1981).

AIR QUALITY

Background

The basic regulatory framework of the Clean Air Act of 1977 involves national ambient air quality standards (NAAQS) and allowable increments for the prevention of significant deterioration of air quality.

NAAQS are absolute, nationwide limits on the amount of certain pollutants that may be present in the air. No part of the country may exceed these levels. The federal government has set primary standards to protect public health and secondary standards to protect the general public welfare. The states of Wyoming and Montana have set their own ambient standards for the same pollutants, which are at least as stringent as the federal standards (see table 3-3).

The PSD program is designed to protect the air quality from significant deterioration in areas already meeting the NAAQS. In other words, in cleaner areas a specific increase, or "increment," in pollution is allowed above the existing air quality "baseline" pollution levels. In no event, however, may pollution increases exceed the NAAQS.

The size of the increment allowable under the PSD program depends on the area's designation as a Class I, II, or III area, with Class I areas allowed the smallest pollution increment and Class III the largest. In the Clean Air Act of 1977, the Congress designated certain national parks and other such areas as Class I areas. All other areas were designated as Class II. However, Congress provided a procedure for state and tribal governments to redesignate areas under their jurisdiction as Class II or III.

Wyoming's and Montana's PSD standards are identical to the federal standards (see table 3-4). Air quality regulations are discussed further in appendix E.

Air Quality in This Region

A report prepared for the BLM by PEDCo Environmental, Inc. (1983) contains a detailed description of the air quality in the region. Most of the region is federal Class II for PSD. However, the Northern Cheyenne Indian Reservation, which is a Class I PSD area, is within 15 miles of tracts north of Decker.

The maximum allowable increases and the federal, Wyoming, and Montana ambient air quality standards are shown on tables 3-3 and 3-4. State standards for ambient TSP generally are more restrictive than the federal standards, with 24-hour standards being a greater restraint than annual standards.

The background rural TSP annual geometric mean concentration for the region is about 15 micrograms per cubic meter. In and near populated areas and mining activities, particulate levels are significantly higher than background levels (see table 3-5).

No monitored violations of federal ambient TSP standards have occurred in Wyoming in recent years. However, the more restrictive Wyoming annual standard has been violated in Sheridan, and the 24-hour state standard has been marginally violated near several mining locations. Monitoring of gaseous pollutants indicated that concentrations are well within state and federal standards.

Air quality monitoring data show that rural background concentrations of sulfur oxide and nitrogen oxide are as follows:

TABLE 3-3
AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal Primary Standards (mcg/m^3)	Federal Primary Standards (ppm)	Wyoming State Standards (mcg/m^3)	Wyoming State Standards (ppm)	Montana State Standards (mcg/m^3)	Montana State Standards (ppm)
Sulfur dioxide	Annual (arithmetic)	80	0.03	80	0.02		0.02
	24-hour	365	0.14	260	0.10		0.10
	3-hour			1,300	0.50		0.50
Total suspended particulates	Annual (geometric)	75		60		75	
	24-hour	260		150		200	
Carbon monoxide	8-hour	10,000	9.00	10,000	9.00		9.00
	1-hour	40,000	35.00	40,000	35.00		22.00
Photochemical oxidant	1-hour	240	0.12	160	0.08		0.08
Nitrogen dioxide	Annual	100	0.05	100	0.05		0.05

SOURCES: National Ambient Air Quality Standards 1970; Wyoming Department of Environmental Quality 1975; Montana State Department of Health and Environmental Sciences 1983.

mcg/m^3 = micrograms per cubic meter. ppm = parts per million

TABLE 3-4
MAXIMUM ALLOWABLE INCREASES
FOR PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY

		Maximum Allowable Air Quality Increases (micrograms per cubic meter)		
Pollutant	Averaging Time	Class I	Class II	Class III
Sulfur dioxide	Annual mean	2	20	40
	24-hour[a]	5	91	182
	3-hour[a]	25	512	700
Total suspended particulates (TSP)	Annual mean	5	19	37
	24-hour[a]	10	37	75

NOTE: These are federal, Wyoming, and Montana ambient air quality standards.

a. The increments for these averaging times are not to be exceeded more than once per year.

Annual arithemtic mean: sulfur oxide, 1 microgram per cubic meter; nitrogen oxide, 2 micrograms per cubic meter.

Maximum 24-hour: sulfur oxide and nitrogen oxide, 9 micrograms per cubic meter.

The only significant sources of sulfur oxide and nitrogen oxide in Wyoming are three power plant units near Gillette.

In Montana, both federal and state ambient annual and 24-hour TSP standards have been violated in the Colstrip area. Colstrip has been designated nonattainment for particulate. Elsewhere, federal and state 24-hour standards are violated near mining areas. No monitoring data for gaseous pollutants were found.

The rural background concentrations measured in Wyoming were assumed to be representative for the Montana portion of the study area. The principal sources of sulfur oxide and nitrogen oxide in Montana are the Colstrip power plant units 1 through 4.

Visibility greater than 60 miles is common. Significant reductions in visibility are generally weather related.

The only mining operations included in the air quality modeling were those that either were in production or had indicated an intention to start the permitting process. The Cook Mountain tract was inadvertently omitted, but it will be analyzed in another computer run to be made before the final EIS is released. The site-specific analysis of the Cook Mountain tract by PEDCo in 1980 did not forecast violations of air quality standards.

TABLE 3-5
AMBIENT BACKGROUND CONCENTRATIONS OF POLLUTANTS IN THE POWDER RIVER REGION

Pollutant	Concentration in micrograms per cubic meter
Sulfur dioxide	
Maximum annual arithmetic mean	1
24-hour maximum	9
3-hour maximum[a]	27
1-hour maximum	82
Total suspended particulates	
Maximum annual geometric mean	15
24-hour maximum	61.5
Nitrogen dioxide	
Maximum annual arithmetic mean	2
24-hour maximum	9

SOURCE: Figures for background concentrations supplied by the state of Wyoming.

[a] Estimate based on rough interpolation between 1-hour and 24-hour maxima; no monitoring data are available for the 3-hour maximum.

TRANSPORTATION FACILITIES

Burlington Northern Railroad operates three main rail lines within the Powder River region. Most coal is carried east on these lines. The Chicago and North Western/Union Pacific line to be constructed in southeastern Wyoming is expected to begin moving coal when construction is completed, reaching a plateau in the amount hauled by 1991 (US, Dept. of Trans. 1980).

Major highways and trafficways are shown on the Regional Activity map, as are rail routes. Outlying areas in the region are connected by a system of county roads, private roads, Forest Service roads, and in Montana, Indian reservation roads.

Resurfacing is planned during the next six years on the section of U.S. Highway 212 from Crow Agency to Busby and from Lame Deer to Ashland. General maintenance along these sections currently costs approximately $3,000 per mile. The section from Lame Deer to Ashland is a heavy snowfall area. The Montana State Highway Department is attempting to implement a pavement management program, which would involve installing a seal coat every 10 years and an overlay every 20 years on highways in this area (Braut 1983).

Wyoming Highway 59 from Gillette to Reno Junction is being reconstructed and should keep up with development in that area. However, Wyoming 59 north of Gillette and U.S 14-16 north of Gillette do not have the structural design or alignment to handle large volumes of traffic from increased development.

There are no current plans to reconstruct either of these roads. An overlay is planned for 18 miles of Wyoming 59 in 1984. Four miles of Wyoming 338 north of Sheridan are to be reconstructed in 1984, and the section of thathighway from the new section around the Big Horn Mine north to the Montana state line is to be reconstructed in 1987 (Hanlin 1983).

Highway and rail systems are discussed further in previously published documents (USDI, BLM 1979b, 1981b; USDI, GS, & Mont. DSL 1979).

A coal slurry pipeline operated by Energy Transportation Systems, Inc., (ETSI) is expected to begin transporting coal by 1990. Slurry preparation plants are planned for the North Rawhide, North Antelope, and Jacobs Ranch areas in Campbell County. The pipeline would compete with railroads hauling coal out of the Powder River Region. More information on the pipeline is available in the ETSI pipeline EIS (USDI, BLM & Woodward-Clyde 1980).

EMPLOYMENT AND SALARIES AND WAGES

This section presents projections of ongoing trends in employment and in salaries and wages for benchmark years in the Powder River Region. All employment projections are based on the regional industrial development that is presented in appendix B. It should be noted that plans that had been formulated for the construction of power plants and generating units in the latter part of the 1980s have been postponed indefinitely. After the completion of Colstrip units 3 and 4, no power plant construction is projected in the region. This is apparently due to forecasts for less demand for electricity than heretofore expected.

The Eastern and Western Powder River Region

General

Soft markets for uranium and coal, the recent recession, and a depressed oil and gas industry have served to lower employment forecasts in many Wyoming counties through 1985. A 12% decline is expected in employment in Converse County by 1985 (see table 3-6). In addition, the closing of the CF&I iron mine and the completion of new railroad facilities in Platte County provide the basis for a 29% decline in Platte County employment by 1985. Firming coal and uranium markets and an improved oil and gas outlook in the last half of the 1980s will increase employment levels substantially by 1990 in all counties except Platte County, which will remain at 80% of the 1980 employment level.

Sheridan County

Employment levels in Sheridan county are unique in that they contain secondary employment induced by development in Montana as well as development in Wyoming. Table 3-7 presents an estimate of the secondary employment induced in Sheridan County by Montana development and estimates of the number of persons employed

TABLE 3-6
PROJECTED TRENDS FOR COVERED EMPLOYMENT[a] AND SALARIES AND WAGES IN BENCHMARK YEARS FOR THE EASTERN AND WESTERN POWDER RIVER REGION

(salaries and wages are in millions of dollars)

County/Sector	1980[b]		1985[c]		1987[c]		1988[c]		1990[c]		1995[c]	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Campbell County												
Coal employment	2,022	54.3	6,200	166.6	7,900	212.1	8,800	236.2	10,500	281.3	12,500	335.6
Construction employment	2,331	49.4	880	18.7	4,400	93.3	4,500	95.4	2,100	44.5	1,200	25.4
All other employment	9,053	151.1	9,920	165.6	10,900	181.9	11,200	186.9	11,900	198.6	12,900	215.3
All covered employment	13,406	254.8	17,000	350.9	23,200	487.3	24,500	518.5	24,500	524.4	26,600	576.3
Converse County												
Coal employment	162	4.0	230	5.6	530	13.2	690	17.2	990	24.7	1,100	27.0
Construction employment	598	12.0	590	11.7	1,600	32.1	1,600	32.1	610	12.2	620	12.4
All other employment	5,171	91.2	4,380	77.2	4,970	87.7	5,110	90.1	5,400	95.2	5,780	101.9
All covered employment	5,931	107.2	5,200	94.5	7,100	133.0	7,400	139.4	7,000	132.1	7,500	141.3
Crook County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	166	2.8	170	2.9	170	2.9	170	2.9	170	2.9	170	2.9
All other employment	1,279	16.2	1,330	16.8	1,330	16.8	1,430	18.1	1,430	18.1	1,430	18.1
All covered employment	1,445	19.0	1,500	19.7	1,500	19.7	1,600	21.0	1,600	21.0	1,600	21.0
Goshen County												
Mining and construction[d]	300	4.1	300	4.1	300	4.1	300	4.1	310	4.2	310	4.2
All other employment	3,120	31.1	3,300	32.9	3,600	35.9	3,600	35.9	3,690	36.8	3,790	37.8
All covered employment	3,420	35.2	3,600	37.0	3,900	40.0	3,900	40.0	4,000	41.0	4,100	42.0
Johnson County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	245	3.5	240	3.4	250	3.6	250	3.6	250	3.6	250	3.6
All other employment	2,040	23.7	2,160	25.1	2,350	27.3	2,450	28.5	2,550	29.6	2,550	29.6
All covered employment	2,285	27.2	2,400	28.5	2,600	30.9	2,700	32.7	2,800	33.2	2,800	33.2
Natrona County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	3,677	69.0	3,600	67.6	3,700	69.4	3,700	69.4	3,800	71.3	3,800	71.3
All other employment	33,925	590.3	35,900	624.7	38,300	666.4	38,900	676.9	39,300	683.8	40,700	708.2
All covered employment	37,602	659.3	39,500	692.3	42,000	735.8	42,600	746.3	43,100	755.1	44,500	779.5

Niobrara County												
Mining and construction[d]	114	1.7	120	1.8	120	1.8	120	1.8	120	1.8	130	1.9
All other employment	619	5.8	660	6.2	690	6.5	700	6.6	710	6.7	730	6.8
All covered employment	733	7.5	780	8.0	810	8.3	820	8.4	830	8.5	860	8.7
Platte County												
Mining and construction[d]	1,366	34.0	10	0.2	10	0.2	10	0.2	10	0.2	10	0.2
All other employment	2,296	24.9	2,590	28.1	2,890	31.3	2,890	31.3	2,990	32.4	3,090	33.5
All covered employment	3,662	58.9	2,600	28.3	2,900	31.5	2,900	31.5	3,000	32.6	3,100	33.7
Sheridan County												
A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table 3-4.												
Weston County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	257	4.0	250	3.9	260	4.0	260	4.0	260	4.0	270	4.2
All other employment	2,291	33.3	2,950	42.9	3,040	44.2	3,040	44.2	3,140	45.6	3,130	45.5
All covered employment	2,548	37.3	3,200	46.8	3,300	48.2	3,300	48.2	3,400	49.6	3,400	49.7

NOTE: Figures may not add due to rounding.

a. "Covered employment" is employment that is covered by unemployment insurance, as reported for the county of employment by the Wyoming Employment Security Commission (WESC).

b. Except for coal employment, all 1980 employment shown herein is actual covered employment as published by WESC. Coal employment for 1980 is an estimate based on industrial planning or the relative weight of coal activity compared to all mining in the county. All 1980 salaries and wages are actual salaries and wages paid to covered employment in 1980, as published by the WESC.

c. All employment projections are derived from the Casper District input-output model. All salary and wage projections are based on 1980 average weekly wages as published by the WESC.

d. Mining and construction have been combined for Goshen, Niobrara, and Platte counties so that individual operations will not be disclosed.

in Big Horn and Powder River counties who will reside in Sheridan County. The secondary employment will reach an interim peak in 1987 as a result of cumulative construction projects in Montana at that time.

The Northern Powder River Region

Table 3-8 presents estimates of employment and salaries and wages for benchmark years in the Northern Powder River region. All counties in this section will experience an interim peak in employment in 1987 because of the cumulative effects of the construction of coal mines and the Tongue River railroad. Employment levels will decline somewhat between 1987 and 1990. Regional coal mines will reach the capacity for full production in 1990, and employment levels should arrive at a plateau between 1990 and 1995.

The Crow and Northern Cheyenne Tribes

Table 3-9 presents estimates of labor force, employment, and unemployment among the Crow and Northern Cheyenne Indians for benchmark years. Figures for 1980 from the Bureau of Indian Affairs, U.S. Department of the Interior (BIA), indicate high unemployment rates for both tribes: 43% for the Crow and 48% for the Northern Cheyenne. Preferential hiring agreements would help to lower these rates.

The Crow Tribe has leased coal on the reservation and as part of that action required preferential hiring of Crow Indians to produce the coal.

Data on wages and salaries among the Indians are not available, but low incomes can readily be assumed in light of the high unemployment rates. In this regard, the assumption can also be easily made that increased employment would raise income levels among the Indians.

POPULATION AND HOUSING

This section presents projections of ongoing trends in population and housing requirements for benchmark years in the Powder River Region. Figures 3-1, 3-2, and 3-3 depict these trends graphically for the counties that will be directly affected by federal coal leasing in 1984. Tables 3-10 through 3-13 present the population projections and housing requirements for the entire region.

The Eastern and Western Powder River Region

General

As with employment trends, Converse and Platte counties will experience a decline in population through 1985, after which Converse County will experience a substantial increase in population (see table 3-10). Platte County will remain at 80% of the 1980 population level, or less, through 1995.

Sheridan County

It is estimated that about 6% of the population in Sheridan County in 1980 was the result, both directly and indirectly, of Montana development. The portion of Sheridan County population that is attributable to Montana developments is expected to grow to about 12½% by 1990 (see table 3-11).

The Northern Powder River Region

Unlike employment trends in the Northern Powder River Region, the only discernable interim peak in population will occur in Big Horn County in 1987 (see table 3-12). This is due to the lower population effects resulting from construction projects, to which the pronounced peak in employment is attributable. Even with the interim peak, 1990 population in Big Horn County is expected to be about 11% greater than that of 1987.

The Crow and Northern Cheyenne Indian Reservations

Table 3-13 presents population projections for the Crow and Northern Cheyenne reservations for benchmark years. In general, population trends on the reservation will follow the population trends of the counties in which the reservations are situated.

TABLE 3-7

PROJECTED TRENDS FOR COVERED EMPLOYMENT[a]
AND SALARIES AND WAGES IN BENCHMARK YEARS
FOR SHERIDAN COUNTY

(salaries and wagea are in millions of dollars)

	1980[b]		1985[c]		1987[c]		1988[c]		1990[c]		1995[c]	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Coal employment	300	7.5	440	11.0	660	16.6	770	19.3	990	24.9	990	24.9
Construction employment	1,127	18.6	1,100	18.3	1,500	24.8	1,500	24.8	1,150	18.9	1,200	19.8
All other employment	6,726	76.4	7,260	82.5	7,810	88.7	7,830	88.9	8,060	91.6	8,210	93.3
All covered employment	8,153	102.5	8,800	111.8	9,900	130.1	10,100	133.0	10,200	135.4	10,400	138.0
Secondary employment induced in Sheridan County by Montana employment[d]	70	0.8	100	1.2	230	2.7	100	1.2	300	3.6	300	3.6
Montana workers residing in Sheridan County[e]	490	13.8	750	21.1	750	21.1	890	25.0	1,140	32.0	1,140	32.0

NOTE: Except as noted, 1980 figures are actual data as reported by the Wyoming Employment Security Commission (WESC).

a. "Covered employment" is employment that is covered by unemployment insurance, as reported for the county of employment by the WESC.

b. Employment projections are derived from the Casper District input-output model. Salary and wage projections are based on 1980 average weekly wages published by the WESC.

c. Coal employment for 1980 is an estimate based on industrial planning and the relative weight of coal activity compared to all mining in the county.

d. Estimate of employment induced in Sheridan County by primary employment in neighboring Montana counties. See footnote "c" to table 3-8 for the methodology used in projecting induced employment. Because covered employment is reported by county of employment, these numbers are included in Sheridan County employment.

e. Industrial estimates of the number of Big Horn County coal mine employees living in Sheridan County in 1982 were 50.89% of estimated 1982 coal employment in Big Horn County. That percentage was used to estimate the number of persons employed in Big Horn County who might reside in Sheridan County for the years indicated. Because covered employment is reported by county of employment, these numbers are included in Big Horn County and Powder River County employment.

TABLE 3-8
PROJECTED TRENDS FOR COVERED EMPLOYMENT AND SALARIES AND WAGES IN BENCHMARK YEARS FOR THE NORTHERN POWDER RIVER REGION
(salaries and wages are in millions of dollars)

County/Sector	1980[a]		1985		1987		1988		1990		1995	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Big Horn County												
Coal employment[b]	954	26.8	1,480	41.6	1,480	41.6	1,750	49.4	2,240	63.1	2,240	63.1
Construction employment[c,d]	589	17.3	320	9.5	1,250	36.8	320	9.5	420	12.3	420	12.4
All other employment[c]	2,351	25.4	2,420	26.1	2,520	27.2	2,400	26.0	2,570	27.8	2,580	27.8
All covered employment	3,894	69.6	4,200	77.2	5,200	105.6	4,500	85.9	5,200	103.2	5,200	103.3
Powder River County												
Coal employment[b]	15	0.3	---	---	---	---	150	3.3	440	9.5	440	9.5
Construction employment[c,d]	33	0.5	30	0.5	550	8.0	30	0.5	40	0.5	40	0.5
All other employment[c]	529	5.8	540	5.9	560	6.1	560	6.1	580	6.3	590	6.4
All covered employment	577	6.6	580	6.4	1,100	14.1	750	9.9	1,100	16.3	1,100	16.4
Rosebud County												
Coal employment[b]	432	12.1	880	24.8	1,040	29.2	1,240	34.7	1,340	37.5	1,410	39.7
Construction employment[c,d]	707	14.9	840	17.8	1,130	23.9	940	19.8	820	17.3	810	17.1
All other employment[c]	2,337	23.3	2,450	24.5	2,620	26.2	2,450	24.5	2,690	26.8	2,700	26.9
All covered employment	3,476	50.3	4,200	67.1	4,800	79.3	4,600	79.0	4,800	81.6	4,900	83.7

NOTE: Figures may not add due to rounding.

a. The 1980 employment is the annual average of monthly employment covered by unemployment insurance, as reported for the county of employment. The 1980 salaries and wages are a summation of covered quarterly salaries and wages. Monthly and quarterly data for 1980 were furnished by the Employment Security Division of the Montana Department of Labor and Industry.

b. The 1980 coal employment is an estimate derived from covered mining employment on the basis of the amount of coal activity compared to other mining activity in the county. Projections of coal employment are based on the relationship of one additional employee for each additional 25,300 tons of projected coal capacity (relationship derived from the Casper District input-output model). Salaries and wages for coal are based on the 1980 weekly average wage for mining.

c. Projected secondary employment is estimated at one additional job in the region for each additional permanent job in energy and 0.5 additional job in the region for each temporary job (as derived from the Casper District input-output model). The secondary employment is then distributed among sectors on the basis of each sector's share of the ten-year (1970-1980) regional change in all employment less mining. The secondary sector change is then distributed to the counties on the basis of each county's share of the ten-year (1970-1980) change in regional employment in that sector. Salaries and wages are projected on the basis of 1980 average weekly wages.

d. Construction projections include construction employment for mines, power plants, and railroads, as applicable, in addition to secondary construction employment. Construction estimates for major projects were obtained from industrial planning and environmental impact statements.

TABLE 3-9
LABOR FORCE, EMPLOYMENT, AND UNEMPLOYMENT
AMONG THE CROW AND NORTHERN CHEYENNE INDIANS IN 1980
WITH PROJECTIONS FOR BENCHMARK YEARS

	1980	1985	1987	1988	1990	1995
Crow Indians						
Labor force	2,019	2,250	2,550	2,400	2,760	2,810
Employment	1,147	1,280	1,450	1,360	1,570	1,600
Unemployment	872	970	1,100	1,040	1,190	1,210
Northern Cheyenne Indians						
Labor force	1,703	2,030	2,250	2,250	2,470	2,530
Employment	886	1,060	1,170	1,170	1,290	1,310
Unemployment	817	970	1,080	1,080	1,190	1,210

NOTE: Data for 1980 are from the Bureau of Indian Affairs, U.S. Department of the Interior. Projections are based on the 1980 ratios of labor force, employment, and unemployment to the population of Indians on the reservation. Figures may not add due to rounding.

REVENUES AND EXPENDITURES

Expenditure Levels

This section presents projections of local expenditure levels for benchmark years in the Powder River Region. The projections are based on per capita spending in the base year, 1979-1980. This was done to maintain the spending standards of the base year. For that reason, debt servicing was included in the base year expenditures. For purposes of this section, it is assumed that projected expenditures will be supported by taxation, user fees, grants, or deficit spending. In instances where localities cannot utilize any of these measures, it must be assumed that requirements for new or additional facilities or services will not be met. In localities where services and facilities are already considered inadequate, it must be further assumed that additional needs will further aggravate an already bad situation.

Projected expenditures follow the trend in employment and population throughout the region (see tables 3-14 through 3-16).

Funding

This section is intended only to indicate the primary sources of funds for local entities in the region. It is not a detailed analysis of the tax structure.

The Eastern and Western Powder River Region

Primary sources of funding for counties in the Eastern and Western Powder River Region include property taxes, sales and use taxes, and bonded indebtedness. Primary sources for communities include sales and use taxes, grants, and bonded indebtedness. Funding for schools is primarily from property taxes, mineral royalty payments, and bonded indebtedness. Funding for water, sewer, highway, road, and street projects in areas either directly or indirectly affected by the production of coal is allocated by the Wyoming Farm Board from the coal severance tax.

It should be noted that there is no mechanism to allocate funds to Sheridan County from Montana coal developments. All severance taxes from Montana coal development accrue to the state of Montana, but a substantial portion of the population impacts occur in Sheridan County. For this reason, some Sheridan County residents would welcome coal development in Sheridan County if only to broaden the tax base.

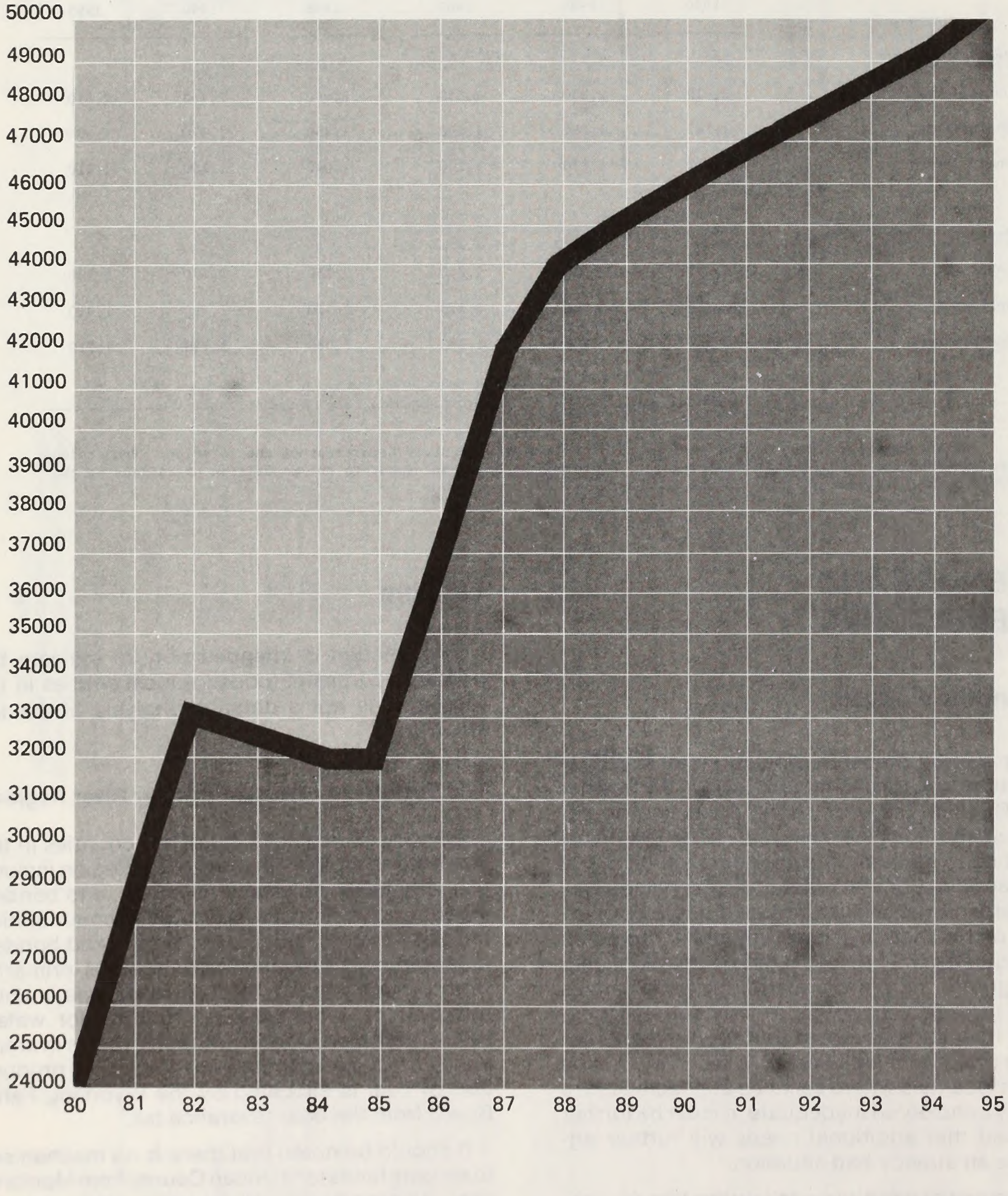


Figure 3-1
POPULATION TRENDS
EASTERN POWDER RIVER — CAMPBELL COUNTY

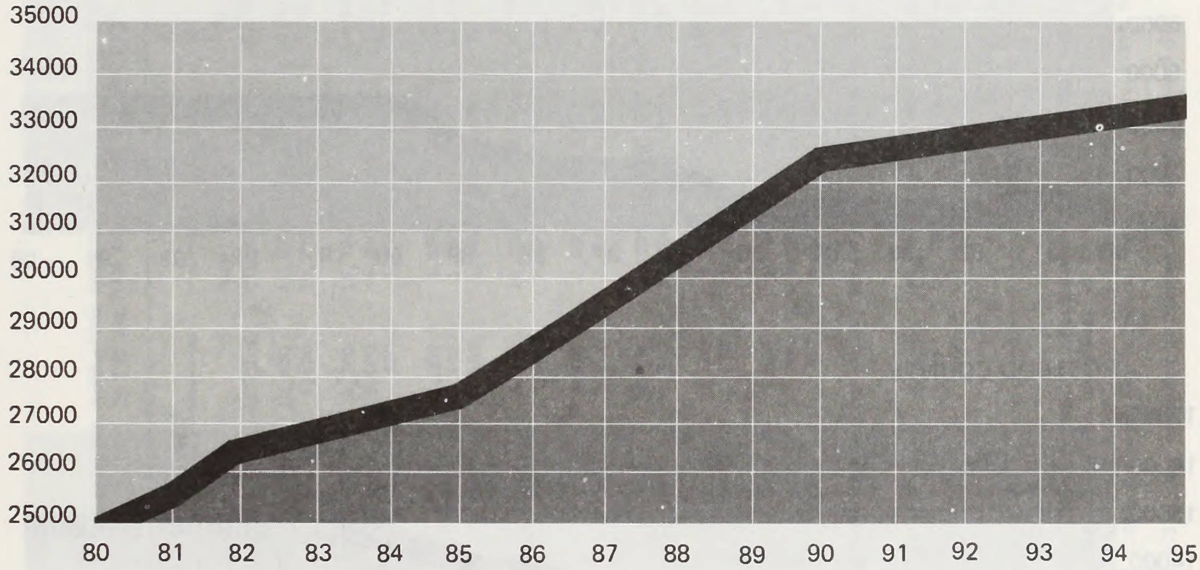
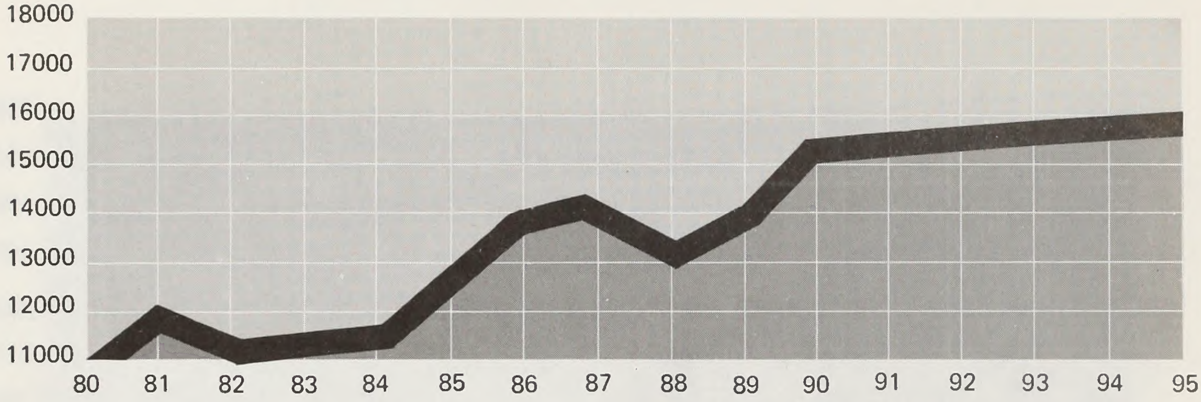
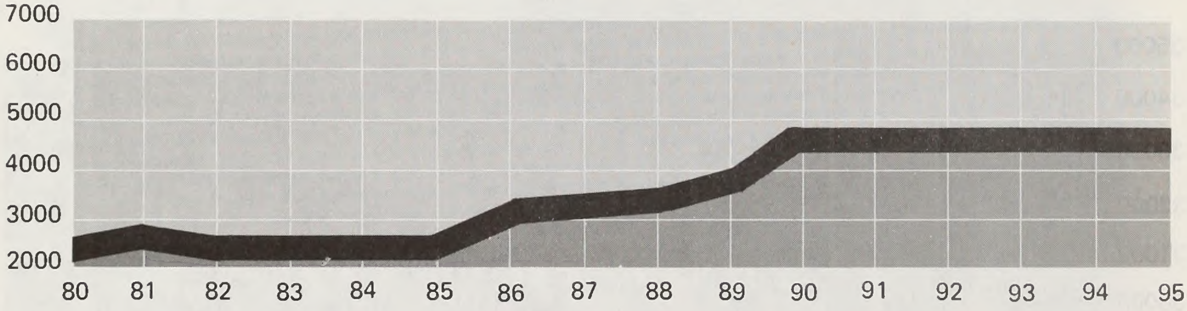


Figure 3-2
POPULATION TRENDS
WESTERN POWDER RIVER — SHERIDAN COUNTY

BIGHORN COUNTY



POWDER RIVER COUNTY



ROSEBUD COUNTY

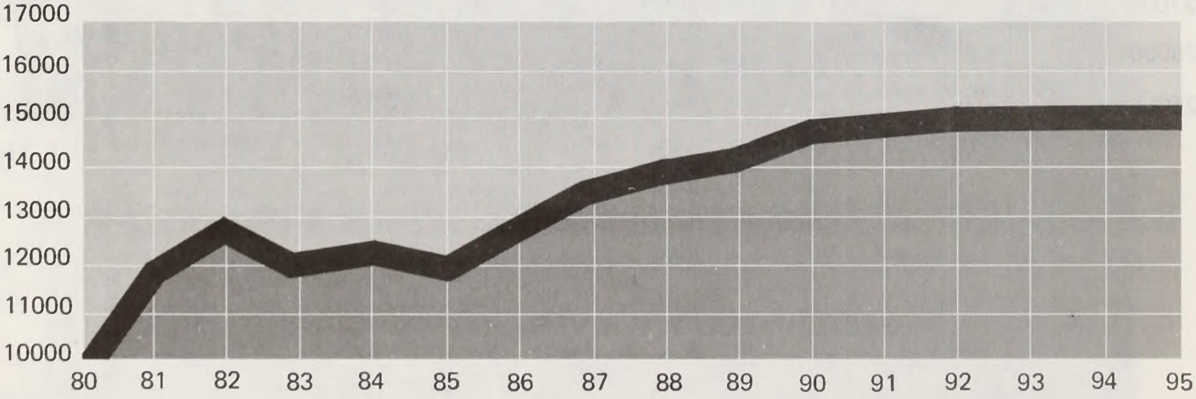


Figure 3-3
POPULATION TRENDS
NORTHERN POWDER RIVER

TABLE 3-10

ESTIMATED POPULATION TRENDS AND HOUSING NEEDS FOR BENCHMARK YEARS IN THE EASTERN AND WESTERN POWDER RIVER REGION

	1980[a]		1985[a]		1987[a]		1988[a]		1990[a]		1995[a]	
County/Community	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Campbell[b]	24,367	9,505	31,900	12,400	41,500	16,200	43,900	17,100	45,600	17,800	50,000	19,500
Gillette	12,134	4,857	15,900	6,400	20,700	8,300	21,900	8,800	22,700	9,100	24,900	10,000
Converse[c]	14,069	5,350	12,400	4,700	15,700	6,000	16,400	6,200	16,700	6,400	17,500	6,700
Douglas	6,030	2,338	5,300	2,100	6,700	2,600	7,000	2,700	7,100	2,800	7,500	2,900
Glenrock	2,736	1,044	2,410	920	3,050	1,160	3,190	1,220	3,250	1,240	3,400	1,300
Crook[d]	5,308	2,434	5,400	2,500	5,600	2,580	5,700	2,630	5,800	2,660	5,900	2,700
Sundance	1,087	479	1,120	490	1,150	510	1,180	520	1,190	520	1,200	530
Moorcroft	1,014	442	1,040	450	1,080	470	1,100	480	1,110	480	1,120	490
Goshen[d]	12,040	5,017	13,200	5,500	14,100	5,900	14,300	6,000	14,600	6,100	15,000	6,300
Torrington	5,441	2,231	6,000	2,460	6,400	2,600	6,500	2,670	6,600	2,700	6,800	2,790
Johnson[d]	6,700	3,029	7,000	3,200	7,600	3,400	7,900	3,600	8,100	3,700	8,300	3,800
Buffalo	3,799	1,673	3,950	1,740	4,300	1,890	4,500	1,980	4,600	2,020	4,700	2,070
Natrona[d]	71,856	28,493	76,800	30,500	81,500	32,300	82,800	32,800	83,800	33,200	86,500	34,300
Casper	51,016	20,259	54,500	21,600	57,900	23,000	58,800	23,400	59,500	23,600	61,400	24,400
Niobrara[d]	2,924	1,434	3,020	1,480	3,130	1,540	3,170	1,550	3,200	1,570	3,250	1,590
Lusk	1,650	777	1,710	810	1,760	830	1,790	840	1,800	850	1,830	860
Platte[d]	11,975	5,053	8,300	3,500	8,900	3,800	9,100	3,800	9,200	3,900	9,500	4,000
Guernsey	1,991	871	1,380	600	1,480	650	1,510	660	1,530	670	1,580	690
Wheatland	5,816	2,516	4,000	1,730	4,300	1,860	4,400	1,900	4,500	1,950	4,600	1,990
Sheridan: A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table 3-11.												
Weston[d]	7,106	2,900	9,400	3,800	9,700	4,000	9,800	4,000	9,900	4,000	10,100	4,100
Newcastle	3,596	1,443	4,800	1,920	4,900	1,970	5,000	2,010	5,000	2,010	5,100	2,050
Upton	1,193	525	1,590	700	1,630	720	1,650	730	1,660	730	1,690	740

a. Figures for 1980 are from the actual census count. Trends were derived by applying 1980 population-to-employment ratios to projected employment. Housing requirements are based on the number of persons per house in 1980.

b. For Campbell County, a ratio of 1.888 was used for permanent employment, plus 1.209 for temporary employment.

c. For Converse County, a ratio of 2.3721 was used for permanent employment, plus 1.209 for temporary employment.

d. Ratios applied for all employment in each county are as follows: Crook, 3.681; Goshen, 3.636; Johnson, 2.932; Natrona, 1.943; Niobrara, 3.868; Platte, 3.097; Weston, 2.981.

TABLE 3-11
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS IN BENCHMARK YEARS FOR SHERIDAN COUNTY

	1980		1985		1987		1988		1990		1995	
	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]
Primary impact of Montana employment	1,410	620	2,180	950	2,180	950	2,590	1,130	3,300	1,440	3,300	1,440
Secondary impact of Montana employment	190	80	280	120	670	290	290	130	800	350	820	360
Base without Montana impacts[c]	23,500	10,300	25,000	10,900	27,100	11,800	28,000	12,200	28,500	12,400	29,300	12,800
County total	25,048	10,928	27,500	12,000	29,900	13,000	30,900	13,500	32,600	14,200	33,400	14,600
City of Sheridan	15,146	6,604	16,600	7,200	18,100	7,900	18,700	8,200	19,700	8,600	20,200	8,800

NOTE: The totals for 1980 are actual census data. Figures may not add due to rounding.

a. Projections of total Sheridan County population are based on the 1980 population-to-employment ratio of 2.8997 for permanent employment, plus 1.2085 for temporary employment. Estimates of primary and secondary impacts to Sheridan County due to Montana employment were made after the population-to-employment ratio was modified by alternately adding and subtracting Montana employment and its effects from Sheridan County employment and population in each projected year. City population is projected at its 1980 share (60.47%) of county population.

b. Housing projections are based on 1980 ratio of 2.292 persons per house for the county and 2.293 persons per house for the city.

c. Base population and housing were derived by subtracting primary and secondary impacts from the total.

TABLE 3-12
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS FOR BENCHMARK YEARS IN THE NORTHERN POWDER RIVER REGION

(figures may not add due to rounding)

	1980		1985		1987		1988		1990		1995	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Big Horn County[a]	11,096	3,867	12,600	4,400	14,100	4,900	13,400	4,700	15,600	5,400	15,700	5,500
Crow Reservation Div.[b]	5,645	1,734	6,400	1,970	7,200	2,210	6,800	2,090	7,900	2,430	8,000	2,460
Hardin Division[b]	4,249	1,737	4,800	1,960	5,400	2,210	5,100	2,090	6,000	2,450	6,000	2,450
Hardin[b]	3,300	1,360	3,700	1,520	4,200	1,730	4,000	1,650	4,600	1,900	4,700	1,940
Northern Cheyenne Div.[b]	1,013	288	1,150	330	1,300	370	1,220	350	1,420	400	1,430	410
Tongue River Division[b]	189	108	210	120	240	140	230	130	270	150	270	150
Powder River County[c]	2,520	1,123	2,520	1,123	3,250	1,450	3,260	1,450	4,640	2,070	4,640	2,070
Broadus Division[b]	1,321	612	1,321	612	1,700	790	1,710	790	2,430	1,130	2,430	1,130
Broadus[b,d]	715	337	715	337	920	430	920	430	1,320	620	1,320	620
East Powder River Div.[b]	725	303	725	303	940	390	940	390	1,340	560	1,340	560
Otter Division[b]	474	208	474	208	610	270	610	270	870	380	870	380
Rosebud County[e]	9,899	3,787	11,900	4,600	13,400	5,100	13,900	5,300	14,500	5,500	14,700	5,600
Ashland Division[b,f]	564	248	680	300	760	330	790	350	830	370	840	370
Ashland[f,g]	415	128	500	150	560	170	580	180	610	190	620	190
Forsyth Division[b]	3,516	1,472	4,200	1,760	4,700	1,970	4,900	2,050	5,100	2,140	5,200	2,180
Forsyth[b]	2,553	1,053	3,100	1,280	3,400	1,400	3,600	1,490	3,700	1,530	3,800	570
Northern Cheyenne Div.[b]	2,651	758	3,200	920	3,600	1,030	3,700	1,060	3,900	1,120	4,000	1,140
Rosebud Division[b]	3,168	1,309	3,800	1,570	4,300	1,780	4,400	1,820	4,600	1,900	4,700	1,940
Colstrip[b]	1,476	475	1,770	590	1,990	640	2,070	670	2,160	700	2,200	710

NOTE: Figures for 1980 are from the actual census count, except where otherwise noted. Housing needs based on 1980 ratio of persons per house.

a. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.992 was used for permanent employment, plus 1.256 for temporary employment.

b. Trends are based on the 1980 share of county population.

c. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 4.367 was used for permanent employment, plus 1.263 for temporary employment. As there was no apparent temporary population in Powder River County in 1980, the average of the temporary ratios for Rosebud and Big Horn counties was used for Powder River County.

d. The 1980 figures for Broadus are from the preliminary census releases.

e. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.997 was used for permanent employment, plus 1.270 for temporary employment.

f. Not to be confused with the Ashland District of the Northern Cheyenne Reservation.

g. Figure for 1980 is an estimate from the Miles City District, BLM.

TABLE 3-13
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS IN BENCHMARK YEARS FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

	1980		1985		1987		1988		1990		1995	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Crow Reservation												
Indian	3,953	801	4,400	890	5,000	1,010	4,700	950	5,400	1,090	5,500	1,110
Non-Indian	2,020	1,038	2,270	1,170	2,540	1,310	2,400	1,230	2,770	1,420	2,810	1,440
Reservation total[a]	5,973	1,839	6,700	2,060	7,500	2,310	7,100	2,190	8,200	2,520	8,300	2,560
Lodge Grass	771	215	860	240	970	270	920	260	1,060	300	1,070	300
Northern Cheyenne Reservation												
Indian	3,101	718	3,700	860	4,100	950	4,100	950	4,500	1,040	4,600	1,070
Non-Indian	563	328	680	400	750	440	750	440	810	470	830	480
Reservation total	3,664	1,046	4,400	1,260	4,900	1,400	4,900	1,400	5,300	1,510	5,400	1,540
Ashland (on reservation)[b]	380	110	460	130	510	150	510	150	540	160	560	160
Birney (on reservation)[b]	145	40	170	50	190	50	190	50	210	60	210	60
Busby[b]	810	230	970	280	1,080	310	1,080	310	1,170	330	1,190	340
Lame Deer[b]	2,000	570	2,400	680	2,670	760	2,670	760	2,890	820	2,950	840

NOTE: Figures may not add due to rounding. Figures for 1980 are from actual census count except as noted. All population projections are based on the 1980 share of county population. All housing projections are based on the number of persons per house in 1980.

a. Includes the portion of the Crow Reservation in Yellowstone County, Montana. This portion was held constant for the projections.

b. Population figures for Ashland, Birney, Busby, and Lame Deer were taken from a statement of the Northern Cheyenne Tribe at the EIS scoping meeting in Ashland, Montana, on May 26, 1983. Housing figures are based on the average number of persons per house for the Northern Cheyenne Reservation in 1980.

TABLE 3-14
LOCAL EXPENDITURE LEVELS IN THE EASTERN AND WESTERN POWDER RIVER REGION
IN 1979, WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1979[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Campbell County	13,681.1	18,800	24,500	25,900	26,900	29,500
School District 1	35,885.2	49,300	64,200	67,900	70,600	77,300
Gillette	10,122.0	14,000	18,200	19,200	20,000	21,900
Converse County	8,304.0	7,800	9,900	10,300	10,500	11,000
School District 1	15,279.5	14,300	18,200	19,000	19,300	20,300
Douglas	6,690.0	6,200	7,900	8,300	8,400	8,800
School District 2	5,735.5	5,400	6,800	7,100	7,200	7,600
Glenrock	1,234.0	1,100	1,400	1,500	1,500	1,600
Crook County	3,467.4	3,600	3,700	3,800	3,900	3,900
School District 1	4,578.5	4,800	4,900	5,000	5,100	5,200
Sundance	546.3	600	600	600	600	600
Moorcroft	384.0	400	400	400	400	400
Goshen County	1,899.1	2,100	2,300	2,300	2,300	2,400
School District 1	7,780.9	8,600	9,200	9,400	9,500	9,800
Torrington	4,136.7	4,600	4,900	5,000	5,100	5,200
Johnson County	2,062.3	2,200	2,400	2,500	2,500	2,600
School District 1	5,646.8	6,000	6,500	6,700	6,900	7,100
Buffalo	1,902.3	2,000	2,200	2,300	2,400	2,400
Natrona County	35,668.5	39,400	41,800	42,400	42,900	44,300
School District 1	30,908.8	34,100	36,200	36,800	37,200	38,400
Casper	41,792.5	46,200	49,100	49,800	50,400	52,000
Niobrára County	889.0	900	1,000	1,000	1,000	1,000
School District 1	2,812.5	2,900	3,000	3,000	3,100	3,100
Lusk	1,465.4	1,500	1,600	1,600	1,600	1,600
Platte County	2,773.9	2,000	2,200	2,200	2,200	2,300
School District 1	6,564.4	4,800	5,100	5,200	5,300	5,500
Wheatland	3,147.0	2,300	2,500	2,500	2,600	2,600
School District 2	1,278.0	900	1,000	1,000	1,000	1,100
Guernsey	592.9	400	500	500	500	500
Sheridan County	14,724.3	16,600	18,100	18,700	19,700	20,200
School District 2	9,898.8	11,200	12,200	12,600	13,300	13,600
Sheridan	7,143.8	8,100	8,800	9,100	9,600	9,800
Weston County	3,806.8	5,100	5,300	5,300	5,400	5,500
School District 1	3,671.2	4,900	5,100	5,100	5,200	5,300
Newcastle	1,662.8	2,200	2,300	2,300	2,300	2,400
School District 7	1,307.0	1,800	1,800	1,800	1,800	1,900
Upton	1,341.4	1,800	1,900	1,900	1,900	1,900

a. Actual expenditures reported by local entities. Includes debt servicing.

b. Figures projected on a per capita basis from 1979 per capita expenditure levels.

TABLE 3-15
LOCAL EXPENDITURE LEVELS IN THE NORTHERN POWDER RIVER REGION IN 1980, WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1980[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Big Horn County	6,109.5	6,900.0	7,800	7,400	8,600	8,600
Schools	9,892.3	11,200.0	12,600	11,900	13,900	14,000
Hardin	778.1	870.0	990	940	1,100	1,100
Powder River County	3,887.5	3,887.5	5,000	5,000	7,200	7,200
Schools	2,025.8	2,025.8	2,600	2,600	3,700	3,700
Broadus	162.3	162.3	210	210	300	300
Rosebud County	6,392.5	7,700.0	8,700	9,000	9,400	9,500
Schools	5,911.7	7,100.0	8,000	8,300	8,700	8,800
Ashland[c]	---	170.0	190	200	210	220
Colstrip	4,813.1	5,800.0	6,500	6,800	7,000	7,200
Forsyth	1,341.0	1,600.0	1,800	1,900	1,900	2,000

a. Actual expenditures reported by local entities. Includes debt servicing.

b. Figures projected on a per capita basis from 1980 per capita expenditure levels.

c. Ashland had no formal budgeting in 1980. Projections are based on average per capita spending of Broadus, Hardin, and Forsyth in 1980.

TABLE 3-16
LOCAL EXPENDITURE LEVELS IN 1980 ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1980[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Crow Reservation	6,474.8	7,300	8,100	7,700	8,900	9,000
Lodge Grass	87.0	100	110	100	120	120
Northern Cheyenne Reservation	7,011.5	8,400	9,400	9,400	10,100	10,300

a. Source: For Crow Reservation and Lodge Grass--Mountain West Research-North, Inc., "Decker Area Mines Comprehensive Social Sciences Study," 1983. Report prepared for Montana Department of State Lands and U.S. Office of Surface Mining. For Northern Cheyenne--paper submitted by the Northern Cheyenne Tribe, dated October 27, 1983, containing comments on a review edition of this document.

b. Projected on a per capita basis.

The Northern Powder River Region

The primary sources of funding for counties and schools in the Northern Powder River Region are property taxes and the gross proceeds tax. Montana communities receive funding from property taxes, water and sewage fees, other local use taxes, and grants.

Communities can also develop special improvement districts for major projects (sewer, water, streets). The Montana Coal Board receives an allocation of 8¾ of the Montana coal severance tax to provide grants for the purpose of alleviating impacts.

The Crow and Northern Cheyenne Indian Reservations

The primary sources of revenue for the Crow Tribe are mineral leases, permits, bonuses, and royalties.

The primary sources of revenue for the Northern Cheyenne are grazing fees, timber fees, investment income, private contributions, fees for mineral exploration, and federal assistance. The Northern Cheyenne Tribe emphasizes that these revenues are not reliable and have declined substantially in recent years. In addition, the tribe has emphasized the inadequacy of facilities and services on the reservation. Given the declining revenues, these inadequacies can only intensify at the cost of degrading the quality of reservation life.

Legislation recently enacted by the Montana state legislature allows the Montana Coal Board to allocate 7% of its funds for loans and grants to Indian tribes and state agencies beginning October 1, 1983. However, this only imparts the right to apply for loans or grants; it does not guarantee funding.

COMMUNITY SERVICES

This section presents estimates of community service levels that would be required for the projected populations in the Powder River Region for benchmark years. The estimates are based on the levels per thousand population that existed in 1979-1980. This is done in order to maintain the standards that existed in the base year. Where there was no existing service, estimates are based on a standard that is footnoted on the table. Tables 3-17 through 3-22 present community service requirements for the Eastern and Western Powder River Region; tables 3-23 through 3-28 present requirements for the Northern Powder River Region; and tables 3-29 through 3-34 present requirements for the Crow and Northern Cheyenne.

SOCIOLOGY

In this section, after the social environment of Wyoming and Montana counties is described, the Crow and the Northern Cheyenne tribes and reservations are covered independently as social units. Even though the land areas are relatively large and the reservations include several small towns in Big Horn and Rosebud counties, the different administrative, political, and cultural structure of these areas justifies their treatment as separate entities.

Each potentially affected community and tribe is then portrayed in terms of its relative capacity to absorb changes that would occur through coal leasing. The criteria used in making these judgments are presented.

Wyoming

Campbell County

The effects of coal mining in Campbell County have been extensive over the past decade. The total population reached 24,367 in 1980, up from 12,957 in 1970. Projections for 1985 population in the county and in the city of Gillette are 31,900 and 15,900, respectively. Some believe these populations were considerably higher by 1982; however, the recent recession and the current depressed state of energy production suggest more conservative projections for 1985. The only other significant population center in Campbell County is the town of Wright, 40 miles south of Gillette, which has an estimated 1980 population of about 1,300.

Campbell County and Gillette are industrial areas. About 48% of the total county employment in 1982 was in the mining (petroleum, coal, and uranium extraction) and construction sectors of the economy (Browne, Bortz, & Coddington 1983).

While Campbell County has experienced many growth management problems since the early 1970s, it is now in a solid position to absorb additional growth successfully. Except in mental health care and number of physicians, the city and county have reached a substantial capacity to absorb population growth.

TABLE 3-17
LEVELS OF COMMUNITY SERVICES IN THE EASTERN AND WESTERN POWDER RIVER REGION, 1979-1980

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons Per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full-time	Volunteers	
Campbell				25			
Gillette	4,570	3.6[a]	1.7[a]	31	5	22	31[b]
Converse				10			
Douglas	1,979	3.5	0.3[c]	10		30	31
Glenrock	1,172	1.5	1.5[d]	8		25	
Crook				4			
Sundance	479	0.6[h]	0.3[e]	5		15	16
Moorcroft	437	0.3[f]	0.14[g]	4		28	
Goshen				4			
Torrington	1,663	2.5[h]	[i]	13		40	56
Johnson				8			
Buffalo	1,392	3.8[h]	0.6[j]	7		17	35
Natrona				63			
Casper	13,559	26.0[h]	6 .5	117	95		282
Niobrara				2			
Lusk	574	2.2	0.3[k]	6		24	12
Platte				6			
Guernsey	413[l]	1.3	0.6[e]	7		34	
Wheatland	2,110	4.7	1.7[d]	12		70[m]	43
Sheridan				7			
Sheridan	3,352	10.0	5.0	29	18		97
Weston				5			
Newcastle	1,240	3.5	2.0	10		40	42
Upton	405	0.7	0.4[e]	5		25	

SOURCE: All data from Wyoming Department of Economic Planning and Development except where otherwise noted.

a. The city of Gillette now has an additional 10.1 million gallons per day (mgd) of water after completion of the Madison Project. In addition, a study has been undertaken to provide for construction of sewage treatment facilities with a 7.4 mgd capacity.

b. Expanding to 60 beds.

c. A new sewage system for Douglas is scheduled for completion by 1984.

d. Source: Glenrock Public Works Department

e. Estimate of 1979-1980 requirements based on 300 gallons per capita daily.

f. The town of Moorcroft hopes to buy water from the city of Gillette after the Madison project is completed.

g. The town of Moorcroft is seeking funding for improvement of sewage facilities.

h. Represents peak demand.

i. Torrington has sewage treatment facilities to serve a population of 6,000.

j. Sewage facilities for the town of Buffalo are to be rebuilt between 1981 and 1983.

k. Source: Lusk Water and Lights Department.

l. Source: Superintendent's office, School District 2, Guernsey, Wyoming.

m. Estimate of 1979-1980 requirement based on Casper District average of 12 volunteer firefighters per 1,000 population.

TABLE 3-18
ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				33			
Gillette	6,000	4.7	2.2	41	7	29	41
Converse				9			
Douglas	1,740	3.1	0.3	9		26	27
Glenrock	1,030	1.3	1.3	7		22	
Crook				4			
Sundance	490	0.6	0.3	5		15	16
Moorcroft	440	0.3	0.14	4		29	
Goshen				4			
Torrington	1,820	2.8	a	14		44	61
Johnson				8			
Buffalo	1,450	3.9	0.6	7		18	36
Natrona				67			
Casper	14,500	27.8	6.9	125	102		301
Niobrara				2			
Lusk	590	2.3	0.3	6		25	12
Platte				4			
Guernsey	290	0.9	0.4	5		24	
Wheatland	1,460	3.3	1.2	8		48	30
Sheridan				7			
Sheridan	3,600	10.7	5.3	31	19		104
Weston				7			
Newcastle	1,640	4.6	2.6	13		53	56
Upton	540	0.9	0.5	6		33	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-19
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters Fulltime	Firefighters Volunteers	Hospital Beds
Campbell				43			
Gillette	7,800	6.1	2.9	53	9	38	53
Converse				11			
Douglas	2,210	3.9	0.3	11		33	34
Glenrock	1,310	1.7	1.7	9		28	
Crook				4			
Sundance	510	0.6	0.3	6		16	17
Moorcroft	460	0.3	0.15	4		30	
Goshen				5			
Torrington	1,950	2.9	a	15		47	66
Johnson				9			
Buffalo	1,580	4.3	0.7	8		19	40
Natrona				71			
Casper	15,400	29.5	7.4	133	108		320
Niobrara			0.3	2		26	13
Lusk	610	2.3		6			
Platte				4		25	
Guernsey	310	1.0	0.5	5		52	32
Wheatland	1,570	3.5	1.3	9			
Sheridan				8			115
Sheridan	4,000	11.8	5.9	34	21		
Weston				7			
Newcastle	1,690	4.8	2.7	14		55	57
Upton	550	1.0	0.5	7		34	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-20
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				45			
Gillette	8,200	6.5	3.1	56	9	40	56
Converse				12			
Douglas	2,310	4.1	0.3	12		35	36
Glenrock	1,370	1.7	1.7	9		29	
Crook				4			
Sundance	510	0.7	0.3	5		16	17
Moorcroft	470	0.3	0.15	4		30	
Goshen				5			
Torrington	1,980	3.0	a	16		48	67
Johnson				9			
Buffalo	1,640	4.5	0.7	8		20	41
Natrona				73			
Casper	15,600	30.0	7.5	135	109		330
Niobrara				2			
Lusk	620	2.4	0.3	7		26	13
Platte				5			
Guernsey	310	1.0	0.5	5		26	
Wheatland	1,600	3.6	1.3	9		53	33
Sheridan				8			
Sheridan	4,100	12.1	6.1	35	22		118
Weston				7			
Newcastle	1,710	4.8	2.8	14		56	58
Upton	590	1.0	0.6	7		35	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-21
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				47			
Gillette	8,600	6.7	3.2	58	9	41	58
Converse				12			
Douglas	2,350	4.1	0.4	12		35	37
Glenrock	1,390	1.8	1.8	10		30	
Crook				4			
Sundance	520	0.7	0.3	5		16	18
Moorcroft	480	0.3	0.15	4		31	
Goshen				5			
Torrington	2,020	3.0	a	16		49	68
Johnson				10			
Buffalo	1,680	4.6	0.7	8		21	42
Natrona				73			
Casper	15,800	30.3	7.6	136	111		329
Niobrara				2			
Lusk	630	2.4	0.3	7		26	13
Platte				5			
Guernsey	320	1.0	0.5	5		26	
Wheatland	1,620	3.6	1.3	9		54	33
Sheridan				9			
Sheridan	4,200	12.4	6.2	36	22		120
Weston				7			
Newcastle	1,730	4.9	2.8	14		56	58
Upton	560	1.0	0.6	7		35	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-22
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				51			
Gillette	9,400	7.4	3.5	64	10	45	64
Converse				12			
Douglas	2,460	4.4	0.4	12		37	39
Glenrock	1,460	1.9	1.9	10		31	
Crook				4			
Sundance	530	0.7	0.3	6		17	18
Moorcroft	490	0.3	0.15	4		31	
Goshen				5			
Torrington	2,070	3.1	a	16		50	70
Johnson				10			
Buffalo	1,720	4.7	0.7	9		21	43
Natrona				76			
Casper	16,300	31.3	7.8	141	114		330
Niobrara				2			
Lusk	640	2.4	0.3	7		27	13
Platte				5			
Guernsey	330	1.0	0.5	6		27	
Wheatland	1,670	3.7	1.3	10		55	34
Sheridan				9			
Sheridan	4,300	12.7	6.4	37	23		124
Weston				7			
Newcastle	1,760	5.0	2.8	14		57	60
Upton	580	1.0	0.6	7		36	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-23
LEVELS OF COMMUNITY SERVICES
IN THE NORTHERN POWDER RIVER REGION, 1979-1980

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons Per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full-time	Volunteers	
Big Horn	2,393	---	---	16	---	23	50[a]
Hardin	---	4.0	b	c	---	20	---
Powder River	580	---	---	4	---	15	---
Broadus	---	0.5[d]	e	c	---	f	---
Rosebud	2,536	---	---	19	---	---	26
Ashland	---	g	g	c	---	---	---
Colstrip	---	h	i	c	---	27	---
Forsyth	---	3.5	0.5	c	---	16	---

SOURCE: Miles City District, BLM.

a. A 36-bed nursing home and a 20-unit retirement home are to be opened in 1983.
b. Hardin has sufficient capacity to accommodate a community of 6,000 persons.
c. Community law enforcement is provided by the county.
d. Based on three wells and pumping capacity of 345 gallons per minute.
e. Broadus has a three-cell lagoon of 7.72 acres. Only one cell is in use at present.
f. Firefighting services provided by the county.
g. Sewage and water systems were built in 1980 to accommodate a community of 2,500 persons.
h. Considered adequate for peak populationof 7,200. (Mont. DSL & U. S. OSM, DEIS for Rosebud Mine, 1983.)

i. Adequate to serve 7,500 persons.

TABLE 3-24
ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	2,720	---	---	18	---	26	57
Hardin	---	4.5	a	b	---	23	---
Powder River	580	---	---	4	---	15	10[c]
Broadus	---	0.5	d	b	---	e	---
Rosebud	3,050	---	---	23	---	---	31
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	32	---
Forsyth	---	4.2	0.6	b	---	19	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

b. It is assumed that the county can continue to provide adequate law enforcement services.

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would continue to be utilized at 1/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-25
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,040	---	---	20	---	29	59
Hardin	---	5.1	a	b	---	25	---
Powder River	750	---	---	5	---	19	13[c]
Broadus	---	0.6	d	b	---	e	---
Rosebud	3,430	---	---	26	---	---	35
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	36	---
Forsyth	---	4.7	0.7	b	---	21	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

b. It is assumed that the county can continue to provide adequate law enforcement services.

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-26
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	2,890	---	---	19	---	28	60
Hardin	---	4.8	a	b	---	24	---
Powder River	750	---	---	5	---	19	13[c]
Broadus	---	0.6	d	b	---	e	---
Rosebud	3,560	---	---	27	---	---	37
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	38	---
Forsyth	---	4.9	0.7	b	---	23	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

b. It is assumed that the county can continue to provide adequate law enforcement services.

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the cnunty can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-27
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,360	---	---	22	---	32	70
Hardin	---	5.6	a	b	---	28	---
Powder River	1,070	---	---	7	---	28	19[c]
Broadus	---	0.9	d	b	---	e	---
Rosebud	3,710	---	---	28	---	---	38
Ashland	---	f	f	b	---	4[g]	---
Colstrip	---	h	h	b	---	40	---
Forsyth	---	5.1	0.7	b	---	23	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

b. It is assumed that the county can continue to provide adequate law enforcement services.

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-28
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,390	---	---	23	---	33	71
Hardin	---	5.7	a	b	---	28	---
Powder River	1,070	---	---	7	---	28	19[c]
Broadus	---	0.9	d	b	---	e	---
Rosebud	3,770	---	---	28	---	---	39
Ashland	---	f	f	b	---	4[g]	---
Colstrip	---	h	h	b	---	40	---
Forsyth	---	5.2	0.7	b	---	24	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

b. It is assumed that the county can continue to provide adequate law enforcement services.

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-29
LEVELS OF COMMUNITY SERVICES IN 1979-1980
ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

Reservation/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full-time	Volunteers	
Crow Reservation	a	---	---	15	6[b]	---	---
Crow Agency	a	900[c]	17	12	---	10	34
Lodge Grass	a	274[c]	12	2		10	---
Northern Cheyenne Reservation	a	---	---	15	6[d]	---	---
Ashland (on reservation)	420	72[c]	4	---	---	---	---
Birney (on reservation)	---	72[c]	2	---	---	---	---
Busby	218	144[c]	3	---	---	---	---
Lame Deer	a	360[c]	10	---	---	---	e

SOURCE: Miles City District, BLM.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-23.

b. Part-time firefighters employed by the Bureau of Indian Affairs, U.S. Department of the Interior.

c. Water capacities are based on 625 gallons per minute (gpm) pumping capacity for Crow Agency, 190 gpm for Lodge Grass, 50 gpm for Ashland, 50 gpm for Birney, 100 gpm for Busby, and 250 gpm for Lame Deer.

d. In addition, there is a seven-member forest crew during the summer.

e. At present Lame Deer has an outpatient clinic, four doctors, and three ambulances.

TABLE 3-30

ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	--	--	17	7[b]	--	--
Crow Agency	a	1,000	19	13	--	11	38
Lodge Grass	a	310	13	2	--	11	--
Northern Cheyenne Reservation	a	--	--	18	7	--	18[c]
Ashland (on reservation)	510	90	5	1[d]	--	3[e]	--
Birney (on reservation)	--	84	2	0[d]	--	1[e]	--
Busby	260	170	4	1[d]	--	6[e]	--
Lame Deer	a	430	12	3[d]	--	14[e]	--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-24.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-31
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	---	---	19	8[b]	---	---
Crow Agency	a	1,100	21	15	---	13	43
Lodge Grass	a	340	15	3	---	13	---
Northern Cheyenne Reservation	a	---	---	20	8	---	20[c]
Ashland (on reservation)	560	100	5	1[d]	---	3[e]	---
Birney (on reservation)	---	94	3	0[d]	---	1[e]	---
Busby	290	190	4	2[d]	---	6[e]	---
Lame Deer	a	480	13	4[d]	---	16[e]	---

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-25.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-32
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters Fulltime	 Volunteers	Hospital Beds
Crow Reservation	a	--	--	18	7[b]	--	--
Crow Agency	a	1,100	20	4	--	12	40
Lodge Grass	a	330	14	2	--	12	--
					8	--	
Northern Cheyenne Reservation	a	--	--	20	--	3[e]	20[c]
Ashland (on reservation)	560	100	0.5	1[d]	--	1[e]	--
Birney (on	--	94	3	0[d]	--	6[e]	--
reservation)					--	16[e]	
Busby	290	190	4	2[d]			--
Lame Deer	a	480	13	4[d]			--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-26.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-33
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acrea)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	--	--	21	8[b]	--	--
Crow Agency	a	1,200	23	16	--	14	47
Lodge Grass	a	380	16	3	--	14	--
Northern Cheyenne Reservation	a	--	--	22	9	--	21[c]
Ashland (on reservation)	600	100	6	1[d]	--	3[e]	--
Birney (on reservation)	--	100	3	0[d]	--	1[e]	--
Busby	310	210	4	2[d]	--	7[e]	--
Lame Deer	a	520	14	4[d]	--	17[e]	--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-27.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beda per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-34
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	---	---	21	8[b]	---	---
Crow Agency	a	1,300	24	17	---	14	47
Lodge Grass	a	380	17	3	---	14	---
Northern Cheyenne Reservation	a	---	---	22	9	---	22[c]
Ashland (on reservation)	620	110	6	1[d]	---	3[e]	---
Birney (on reservation)	---	100	3	0[d]	---	1[e]	---
Busby	320	210	4	2[d]	---	7[e]	---
Lame Deer	a	530	15	4[d]	---	18[e]	---

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-28.

b. Part-time firefighters employed by the Bureau of Indian Affiara, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

There are various reasons for this level of capacity. Past experience with growth has prepared officials and citizens to respond effectively. Regulatory functions at the local level (Gillette Planning District, zoning, permitting) and the state level (Wyoming Industrial Siting Commission) are well established. City-county relations appear to be positive. Residents of the area historically have had positive attitudes toward development. There are no large ethnic or racial groups that are vulnerable to social change, and there are elaborate ongoing capital improvement programs at the county and municipal levels.

Gillette's social structure is diverse. More than 48% of the respondents to an extensive 1982 survey of citizens had lived in Gillette for five years or less (Browne, Bortz, & Coddington 1983). When this fact is considered, along with the city's size, it is understandable that Gillette's social atmosphere is relatively urbane. Gillette and the county have firm relations with state government and with several large corporations.

As discussed above, the area's population remains largely transient. This results in several types of community instability. The Campbell County crime rate over the past several years has been higher than Wyoming's as a whole (Wyo. Ofc. of Atty. Gen.). Statistics showthat the incidence of divorce and school dropouts is somewhat higher in this area than in the rest of Wyoming (McGowan 1983). Unemployment has been low over the past several years, but the area's dependence on energy extraction means that labor demand is volatile.

Gillette and Campbell County are therefore well prepared to respond to additional growth, even rapid growth of high magnitude (5 to 10% annually), at the community level. For existing and potential future residents, however, such changes would prolong the relatively high levels of disruptive behaviors and the lack of solidarity evident during the past decades.

The population of Gillette and Campbell County is expected to grow in the next decade or so, whether or not additional federal coal leasing takes place. This expectation is fueled by the belief that the demand for oil, gas, and coal remains relatively consistent. Energy production is the base of the economy in this area and will remain so well into the future.

The population of this area is quite large and diversified. Sound fiscal and service-facility conditions, along with a stable regulatory environment at the state and local levels, mean that both the city and the county are well equipped to deal with future growth. Improvements in community cohesion also should become evident through time as the population becomes less transitory and more stable.

Sheridan County

Sheridan County and the city of Sheridan have been moderately affected by coal development, both historically and in the recent past. However, most of the recent effects have been caused by mining on the Montana side of the state line, as Decker, Montana, area workers have chosen to live in the Sheridan area. Sheridan County's population increased from 17,800 in 1970 to 25,000 in 1980. This pace of increase, 3 to 4% annually, is almost exactly the same as that of Wyoming during the 1970s.

Roughly 80% of Sheridan County's residents live in Sheridan and in the fringe areas near the city. Other communities in Sheridan County are Ranchester, Dayton, and Story. Sheridan County is quite racially homogeneous; 98% of the population is white. The area's economy has shifted from an agricultural base to a services-mining base as coal production has increased in the Decker area.

Perhaps the preeminent issue associated with the effects of coal development on the Sheridan area is jurisdictional. Montana taxes on Montana production are not shared with Sheridan, the location of most social and economic effects. This is widely recognized as inequitable, but there appears to be no mechanism to alter the situation. Wyoming's industrial siting regulations do not apply to Montana operations, but Sheridan has implemented a subdivision review process. There is a planner-grantsperson, an industrial association, and a monitoring program to track socioeconomic change. These measures are assets to Sheridan and Sheridan County.

It is reported that Sheridan area residents typically support additional growth but want it to occur at a moderate pace (Mtn. West 1983). Sheridan residents, like those in other areas, apparently recognize that reliance on agriculture as an economic base is, over the long term, less than optimal for stability and growth. Additional diversification was evident in the rapid retail expansion that occurred in the 1970s, particularly in franchised operations.

The administrative-political environment also has changed Sheridan lost some of its small-town atmosphere as growth management processes were implemented, the bureaucracy grew, and the area became more urban. Coordination between the city and the county, and between those entities and the state, is generally well established.

While the mining employees from the Decker area may not have been particularly well integrated into the community, it appears that Sheridan absorbed the changes of the 1970s without widespread disruption. Examination of divorce, dropout, crime, and unemployment figures for the past several years reveal that these rates are comparable to or lower than those for Wyoming as a whole (McGowan 1983, Browne, Bortz, & Coddington 1983). This is evidence that, all things considered, the moderate increases in population during the past decade did not have a traumatic effect on the community and its residents.

Sheridan and Sheridan County are in a good position to deal with the moderate growth levels forecast for the next several years if no additional federal coal in the area is leased. As in Gillette and Campbell County, local economic dependence on energy production means there would be some vacillation in employment and expenditure levels through time. However, the economy of the Sheridan area is somewhat more balanced than that of the Campbell County-Gillette area. Radical shifts in social stability are not expected—the projected growth will be vigorous without being disruptive.

Montana

Rosebud County

The principal communities in Rosebud County that would be affected by federal coal leasing are Forsyth, Colstrip, and Ashland. Forsyth, the county seat, is on the northern edge of Montana areas that have been influenced by past and present production. Its population increased at a moderate pace through the 1970s (from roughly 1,900 in 1970 to 2,600 in 1980), largely because of construction activities at Colstrip. Ongoing public dialogue on the local benefits and costs of additional coal development has accompanied the development that has occurred south of Forsyth. It appears that the leadership in Forsyth has been quietly supportive of the changes while many of the ranchers in the county have been and remain vigorously opposed to coal mining and conversion. This has resulted in some polarization in Forsyth and Rosebud County (Hooper and Branch 1982).

Forsyth is moderately diverse economically, politically, and socially. The effects of Colstrip construction on Forsyth were lessened by the short time that newcomers lived there during the 1970s. Many did not stay long enough to have great influence.

Ties between Forsyth and the state of Montana appear well developed, as the Montana Coal Board has granted substantial funding to Rosebud County. Furthermore, the city historically has interacted extensively with the Burlington Northern Railroad and the Montana Power Company. Thus, Forsyth and the county are fairly well connected to higher levels of government and to corporate organizations. However, these linkages have not helped Forsyth toaddress a persistent problem, medical care.

The moderate growth that was mainly due to Colstrip activities during the 1970s did cause some expansion of local government and attendant growth of the bureaucracy. Nevertheless, Forsyth maintains a small town atmosphere, with most relations being personalized.

Colstrip, about 25 miles south of Forsyth, is the center of energy development in Rosebud County. It has been transformed during the past decade. Its population grew from about 200 in 1970 to roughly 3,200 in 1980 for the portion of Rosebud County that includes Colstrip. Inevitably this resulted in extensive changes. Unlike that of the rest of the county, Colstrip's economy and labor force are tied almost exclusively to industrial mining and conversion processes. Perhaps because the population has been largely transient, Colstrip residents have been described as apolitical. An effort to incorporate Colstrip as a municipality was defeated, so the community remains dominated by the Montana Power Company (Mont. DSL 1982b).

Given its size, Colstrip is quite diverse. Many "blue-collar" and managerial persons and families have settled in Colstrip either permanently or temporarily. Because few of them grew up in Rosebud County, there is low identification with local affairs or with long-term local residents. Cohesion in the town is considered low; this is predictable given the circumstances of Colstrip's change.

Colstrip's major assets are its relationship with the Montana state government and with Rosebud County. Because of the growth during the 1970s, Colstrip received a lot of attention from the Montana Coal Board and other state agencies, and from the county. Its share of Rosebud County's population increased from about 3% in 1970 to more than 30% in 1980. State and county resources were funneled into Colstrip as it attempted to deal with the wholesale changes that took place.

Ashland is another unincorporated town in Rosebud County. Its location on the eastern edge of the county and the area's transportation network have prevented its being affected much by coal mining and conversion activity to the northwest at Colstrip or by mining to the southwest in the Decker area. The population of Ashland, estimated at about 400, appears to be stable. The economic base of Ashland is limited—it contains a Forest Service Office, Saint Labre Mission School, a sawmill that operates intermittently, and some small services and retail operations.

It is reported that Ashland lacks cohesion socially. Because of its proximity to the Northern Cheyenne reservation, the community has a sizable Indian population as well as non-Indian residents. For that reason it is somewhat fragmented. The community is very informal, but this has not facilitated collective action in the past. As a community, however, Ashland has developed better ties with Rosebud County and the Montana Coal Board than previously existed. This has been accomplished through the county planning board and by the development of a water-sewer board that applied for and received a grant from the Montana Coal Board (Hooper and Jobes 1982).

For Rosebud County as a whole, conventional indicators of social well-being do not reveal profound existing problems. Reported crime has been low relative to other counties in Montana as recently as 1981 (Mont. Bd. of Crime Control). The divorce rate has fluctuated but generally has been below the nation's rate during the 1970s. Unemployment has been relative to construction activity at Colstrip. A significant problem for residents of Rosebud County has been the persistent shortage of medical care, a chronic situation in many rural areas.

It is projected that Rosebud County will experience significant population growth through the late 1980s and early 1990s if no additional federal coal leasing takes place. This expected growth will occur in the main communities, Forsyth and Colstrip, where it will be due largely to inmigration. Growth to a lesser extent is expected on the Northern Cheyenne Reservation. Given the locations and magnitude of these potential increases, patterns of community social life should not be distrupted beyond systemic changes involving the larger society.

Powder River County

The community most likely to be affected in Powder River County is Broadus, the county seat. The establishment of the Belle Creek oil field caused a small boom in Broadus in the late 1960s and early 1970s. The county's population has been fairly stable for some time, ranging from 2,000 to 3,000. Roughly 700 of these persons live in Broadus.

Revenues generated by the Belle Creek field have generally enabled Powder River County to provide adequate services. The major deficits are in medical care and housing, neither of which is typically addressed by county or municipal government. Exhaustion of the Belle Creek field through time will require the county government to obtain alternative sources of revenue or to reduce the level of services.

Broadus, a small town with characteristics more or less typical of such communities, serves as a trade center for the surrounding rural agricultural area. It is very informal, and its economy is not highly diversified. Linkages to state government and corporate organizations are limited, but the recent appointment of a county commissioner to the Montana Coal Board should be helpful in establishing ties to an important potential source of revenue.

Land use planning efforts in Powder River County, driven by expectations that coal development would cause population increases, have not been favorably received. Given that there has also been some recent instability in Broadus government, it appears that rapid growth would require both city and county government to quickly implement some management processes that are not now available. However, there is willingness and openness to economic growth among community leaders. This reflects the general atmosphere in the town and in the county. There is ongoing opposition to coal development in Powder River County, but persons holding these views are reportedly a small segment of the population, mostly living in the western areas of the county (Myers, Davidson, and Trent 1983).

Review of crime, divorce, unemployment, and similar indicators of social problems reveals that general stability prevails in Powder River County.

In summary, Broadus and Powder River County, facing long-term economic decline and the absence of alternative means of broadening the economic growth base, generally appear favorable toward coal extraction in the county. However, present capabilities to deal with the consequences of such activity are quite limited in comparison with other regional communities that have already experienced either moderate or large-scale growth.

The population of Broadus and Powder River County may grow considerably during the next decade, with Broadus being the focus of the changes during the late 1980s and early 1990s. Should this growth materialize, the area's social setting will be affected. Pressures on services and facilities will be evident as leaders try to keep pace with increased demands. Interpersonal relations will become more impersonal as newcomers, many with industrial occupations and without local ties, enter the area. The growth figures are not large in absolute numbers, but Powder River County is so sparsely populated now that even small numbers of newcomers can have a significant effect.

Big Horn County

The main communities in Big Horn County that would be affected by additional regional coal development are Hardin (the county seat), Crow Agency, Lodge Grass, Wyola, Busby, and Kirby. Busy is on the Northern Cheyenne Reservation, and Crow Agency, Lodge Grass, and Wyola are on the Crow Reservation. Historically, the county's population has been quite stable. About 11,000 persons lived in Big Horn County in 1980, and roughly one-half of them were either Crow or Northern Cheyenne. There has recently been a slight out-migration of non-Indians and a steadily increasing Indian population; thus, the Indian population now amounts to a higher proportion of the total than in the past.

Agriculture has been the keystone of the economy of Big Horn County, but agricultural employment decreased by almost one-half from 1960 to 1980. Increases in other sectors have compensated for these reductions. Big Horn County is in a solid position as to public revenues—it receives revenues from several large coal mining operations.

As in other southeastern Montana areas, the county is fragmented by its cultural diversity. The presence of two Indian reservations has meant that authority is often unclear and jurisdictional issues are seldom settled to the satisfaction of all parties. Further complicating this source of division is the fact that much land on the reservations, particularly the Crow Reservation, is held by non-Indians. Given the multiple jurisdictions, coordination of local response to issues is complex. Big Horn County has tried to develop a planning board, but the principal reason for its existence, population growth associated with energy development, has not materialized to a significant level (Mtn. West Rsch. 1983). Population increases associated with the Decker area mines in Big Horn County have taken place primarily in Sheridan and Sheridan County, Wyoming.

Indicators of well-being for Big Horn County are mixed. It has had low divorce and suicide levels, yet per capita income has been consistently lower than that of Montana as a whole, and unemployment levels have been consistently higher. Unfavorable economic conditions on the Crow and Northern Cheyenne reservation are doubtless responsible for these chronic local problems.

If there is no additional federal coal leasing, Big Horn County is expected to grow at a moderate pace. Much of the change is expected to occur on the Crow Reservation. In areas not included in either Indian reservation, the changes should be subtle, incidental, and not the source of major conflicts or issues.

The Northern Cheyenne

The Northern Cheyenne Indian Reservation occupies about 450,000 acres in Rosebud and Big Horn counties. The tribe has estimated the population of the two major settlements, Lame Deer and Busby, at 2,000 and 810, respectively (Northern Cheyenne Tribe 1983b). The villages of on-reservation Ashland (across the Tongue River from the Ashland discussed previously) and Birney, further south on the Tongue River (across the river from predominantly non-Indian Birney), also are significant population centers on the reservation. The rest of the reservation population lives in the country.

Relative to non-Indian communities, the Northern Cheyenne reservation is culturally homogeneous, even though the tribe estimates that 15% of the area's population is non-Indian (Northern Cheyenne Tribe 1983b). Traditional cultural values are strong on kinship, spirituality, and the natural environment. This is especially influential in such traditional villages as Birney (Mont. DSL 1982a).

There has been some oil and gas exploration on the reservation, but the tribe has opposed on-reservation coal extraction without tribal control. Tribal policy regarding off-reservation development is largely attached to the potential for tribal members to obtain employment and other benefits at mines and facilities within daily commuting distance of the reservation. If this potential cannot be realized, it is likely that the tribe will oppose the proposed development. The tribe also expressed concern about air quality, water quality, tribal government operations, and maintenance of the existing culture. Making tradeoffs between economic development and cultural preservation is a continuing dilemma for the Northern Cheyenne Tribe and its members (Kroll 1983).

Given the absence of other economic development proposals, and with access to potential benefits, coal development in the vicinity of the Northern Cheyenne Reservation may present an opportunity for the tribe to address several pressing problems. Unemployment is chronically very high. The age structure of the population means that expansion of the potential labor force is inevitable. Alcohol abuse is apparently widespread.

The tribe is responsible for providing several basic services, but its funding is limited. The federal presence on the reservation is also evident, as the Indian Health Service (IHS), Bureau of Indian Affairs (BIA), Public Health Service (PHS), and other federal and Montana agencies are also providing services. Services provided are municipal services (BIA), health services (PHS and IHS), welfare and social services (state of Montana and BIA), community health representative (PHS and IHS), education (BIA), housing (HUD), and water (IHS) (Northern Cheyenne Tribe 1981). Thus, the tribe and other institutions share the responsibilities for responding to reservation social conditions. The tribe has reported that tribal liability is increasing as federal funds have diminished over the past several years.

Without economic development of some sort, the cycle of poverty now evident on the reservation will persist and probally will be aggravated in the future. An employment agreement with the Montana Power Company for designation of jobs for Northern Cheyenne has evidently been effective over several years in providing employment opportunities.

Northern Cheyenne Tribe representatives met with BLM representatives in May 1983 to discuss tribal concerns associated with possible federal coal leasing. The tribe said the EIS should address the potential effects listed below (Northern Cheyenne Tribe 1983b).

Effects of leasing on tribal government operations. Ability of the tribal government to respond to the potential changes brought on by leasing.

Effects of leasing on the Northern Cheyenne culture and homeland. The extent to which coal development in the vicinity could endanger the reservation as the homeland of the Northern Cheyenne.

Effects of leasing on reservation communities. Effects on reservation communities such as Lame Deer and Busby.

Effects on services and facilities on the reservation. How regional population increases could affect the tribe's provision of services and facilities, and how those effects could be mitigated.

Effects on public finance. The tribe felt the EIS should address the revenue and expenditure processes of the tribe and the reservation.

Effects on law and order. Effects on traffic and other potential law enforcement problems caused by leasing in the vicinity. Mitigation also should be analyzed.

Employment Opportunities. The tribe said that the EIS should consider the level of living of tribal members and the possibility of using employment preferences as a mitigating measure.

Potential population increases. The effects of population increases in the region, both on and off the reservation.

Mitigative measures. The tribe is particularly interested in the use of lease stipulations as a means of mitigating adverse effects on the tribe.

Adequacy of site-specific analyses. The tribe belives that site-specific analyses should be included in the regional EIS.

Maintenance tract treatment in the EIS. The tribe feels that development of maintenance tracts would result in increased production and new impacts.

The "no action" alternative, the need for leasing, and cumulative analysis in the EIS. The tribe belives that the "no action" alternative is misleading with regard to additional development, that additional leasing needs should be analyzed, and that cumulative impacts should be examined.

The future population on the Northern Cheyenne Reservation is forecast to be higher than the present level. This moderate growth, in concert with some form of economic development on or near the reservation that would generate jobs, could give the tribe and its members an opportunity to begin to address their prevailing substandard living conditions. However, the likelihood of this happening is quite low. Capital investment in the present and the forseeable future is very limited. For these reasons, there is likely to be no improvement in chronic problems such as alcoholism, housing, education, unemployment, and health in the future.

Government policies and programs will vary, with attendant fluctuations in funding. These changes will have some consequences; however, without stable improvements in economic opportunity, the near-term and mid-term outlook for improving living conditions among the Northern Cheyenne is not good.

The Crow

The Crow Indian Reservation, west of the Northern Cheyenne, contains another indigenous Native American population in southeastern Montana. The reservation is very large, 2.25 million acres, but the tribe owns only about 350,000 acres. The rest is controlled by individual Crow, non-Indians, and the state of Montana. Most of the reservation is in Big Horn County, with part of Yellowstone County also within reservation boundaries. Principal Crow Reservation communities are Crow Agency, Lodge Grass, Wyola, Saint Xavier, and Pryor, all of which are quite small. Hardin is a major off-reservation city just north of the boundary.

Cultural homogeneity within the tribe is relatively high because of historical continuity. The Crow and their leaders, unlike the Northern Cheyenne, appear to be convinced that industrial development on the reservation and in the vicinity does not present a threat to the Crow culture. The Crow have encouraged development of coal resources on the reservation as a means of economic expansion (Amer. Ind. Tech. Svcs. 1983). The tribe also has an agreement with Westmoreland Resources at the Absaloka mine, which has led to the hiring of Crow employees (Pacifica 1982).

The Crow also are highly dependent on nontribal sources for basic services and facilities. The economy is not highly diversified, and with a young population causing future expansion of the potential labor force, economic development is critical. However, such proposals have been met with considerable internal controversy within the tribe. Crow government is democratic, and dissent is a fundamental part of the tribe's decision process. This leads to delays as the tribe establishes policy. It now appears, after several years of discussion within the tribe, that the Crow want to take advantage of coal extraction on the reservation as a means of presenting job opportunities to tribe members (Amer. Ind. Tech. Svcs. 1983).

The future of the Crow tribe and its members is tied to economic development in some form, as is that of the Northern Cheyenne. The Crow are open to coal development on the reservation, however. Should this occur, at least a segment of the population would benefit directly, and all tribal members would receive some monetary benefits or benefit from improved services and facilities.

The Crow population is expected to increase in the next decade. Further declines in living conditions should be expected unless employment opportunities keep pace. Reliance on shifting government programs carries the risk that artificial and temporary solutions will be applied to fundamental structural conditions. Such programs may not be conducive to long-term improvements. Therefore, genuine economic development represents a sounder approach, and energy development may be one of the very few potential sources of such development for the tribe.

Capacity of Communities to Absorb Change

This section summarizes the twelve factors that influence the ability of a community to respond to growth and change (Mtn. West 1982). Observations are made about each community in the Powder River Region.

History of Development

Substantial development has occurred near Gillette, Sheridan, and Colstrip. Forsyth and the Cheyenne have been moderately affected by Colstrip, as have Hardin and the Crow by mining at Westmoreland. Broadus has gone through the Belle Creek experience, but that was a decade ago, and the field is well removed from the city. Ashland is in the vicinity of change but little has actually happened there.

Cultural Characteristics

As Native American communities, the Crow and Cheyenne are inherently more vulnerable to harm from industrialization than are predominantly white communities. Forsyth, Broadus, and Ashland are characterized as having relatively large populations of long-term residents.

Population Size and Change

Gillette and Sheridan are the area's largest communities. The Crow and Cheyenne have sizable populations, but they are dispersed over large areas. Broadus and Ashland are simply small towns. Colstrip, Forsyth, and Hardin are intermediate.

Labor Force

Gillette, Sheridan, and Colstrip have relatively large industrial labor forces that may or may not be consistent with local labor demand at any particular time. Forsyth's labor force is intermediate because of Colstrip and the railroad. Because of the Montana Power Company agreement and Westmoreland, the Cheyenne, the Crow, and Hardin also have some labor that could respond to new development. Ashland and Broadus have limited industrial labor forces.

Facilities and Services

Colstrip would be in a better position to deal with growth if it were incorporated. The Crow and Cheyenne are largely dependent on other government entities. Otherwise, facilities and services are tied closely to population.

Local Regulations

The siting law in Wyoming is advantageous to Sheridan and Gillette, even though Decker development is not covered. Rosebud County has planning. Powder River County does not have organized planning; however, Broadus is incorporated. Colstrip has been tightly controlled even though it is unincorporated. The Crow and the Cheyenne have autonomy, but land use controls apparently are not feasible.

Leadership Experience

With a few exceptions, leadership experience parallels history of development. Colstrip apparently lacks formal, noncorporate leaders and stability even though its experience is extensive. Leaders at the county level in Big Horn County have had significant ongoing exposure to coal issues. Broadus and Powder River County are now represented on the Montana Coal Board, but they have not gone through recent growth. Even with changing leadership, the Crow and the Cheyenne have been involved in negotiation processes with companies.

Attitudes

Gillette and Campbell County have historically been very favorable toward development. Sheridan is more moderate. The Montana areas are mixed, with support in the towns and significant opposition in rural areas. The Crow are open to mining on-reservation. The present Northern Cheyenne policy is to exclude on-reservation coal development.

Economic, Social, and Political Diversity

The Crow and the Cheyenne are culturally and economically homogeneous. Gillette and Sheridan are relatively large and complex. The other communities fall between these extremes.

Linkages to Nonlocal Organizations

Gillette and Sheridan are well connected to state government and corporate organizations. Colstrip is linked to Montana Power and Forsyth to Montana Power and the railroad. The other Montana communities are more isolated, largely because of lack of development in the immediate vicinity. The Crow and the Northern Cheyenne have no experience in applying for Montana Coal Board funds.

Coordination

City-county-state coordination is high in Gillette and Sheridan. The Crow have much internal dissent, and the Northern Cheyenne are not closely associated with state-county government. Ashland lacks cohesion. Forsyth, Broadus, and Colstrip are intermediate.

Patterns of Interaction

Gillette, Sheridan, and Colstrip are relatively urban communities with established bureaucracies. Broadus, Ashland, the Cheyenne, and the Crow are personalized, small communities even though there are bureaucratic, professional presences on the reservations. Forsyth is in transition and Hardin is intermediate.

Conclusions

Consideration of the above leads to the following conclusions.

Gillette and Sheridan have a high capacity to absorb change. Colstrip, Forsyth, and Hardin are communities with moderate capacity to absorb change, and Broadus, Ashland, the Northern Cheyenne, and the Crow have limited capacity to absorb change.

The potential for widespread disruption, given similar levels of development and population growth, is lowest for the two Wyoming communities and highest for the communities with limited capacities.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the environmental consequences of each alternative. A comparison of these effects appears on table 2-2 in chapter 2. When there would be any unavoidable adverse impacts or irreversible or irretrievable commitments of resources, discussion of these effects is included in the analysis of each resource. In the same way, the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity is discussed in the analysis of each resource.

Analyses in this document are focused on 1990; however, the time has been expanded to 1995 when necessary to include maximum development. The analyses presented in this chapter were based on the professional judgment of resource specialists when other sources of information were not available.

The individual tract profiles contain site-specific discussions of the impacts of development on each tract, as well as a discussion of agricultural economics.

GEOLOGY AND MINERALS

The only major impact of Alternatives 2 through 6 on geology would be the removal of the coal. The direct impact to topography is insignificant in itself, but the changes would affect wildlife. Those effects are discussed in the "Wildlife" section of this chapter.

Removal of the coal beds and destruction of the strata overlying them would be unavoidable. There would be no short-term impacts on geology. A long-term impact would be the consumption of the coal, which would make it unavailable for future use.

An irreversible effect of Alternatives 2 through 6 would be the consumption of the coal. Recovery of the minable coal in any mining operation is never 100% efficient; normally, 10% to 15% of the coal remains after mining. The coal that remained would be irretrievably lost to future use.

SOILS, VEGETATION, AND RECLAMATION

The total acreage disturbed by mining and related land uses under each alternative is shown in table 4-4 in the "Land Use" section. Impacts would result from the removal of topsoil and vegetation and from the handling and stockpiling of topsoil.

Impacts to subsoils (for example, argillic horizons) could occur in the form of destruction of the soils' structure, which may take thousands of years to develop. Destruction of these soil aggregates (also referred to as peds) could be expected to decrease rates of permeability and infiltration and to decrease air exchange and available-water-holding capacity.

In arid climates, soil structure and bulk density are very important to soil properties affecting the moisture regime of soils. A soil composed of stable soil aggregates arranged loosely maximizes pore space and minimizes bulk density. This results in significantly higher effective moisture than that within a compacted soil. A more favorable moisture regime can be expected to result in higher annual forage production, greater plant cover to reduce erosion, and more palatable forage during the warm season, which should better distribute range utilization by foraging animals.

Large-scale destruction of soil aggregate structure would occur if heavy equipment was driven over moist soil during reclamation. Mitigating measures intended tp reduce or eliminate these impacts are included in appendix C.

Dilution of the solum by less fertile substratum material would result in a decrease in the fertility of the soil. The substratum horizons typically contain significant accumulations of calcium carbonate and sometimes soluble salts, which are detrimental to seed germination and water uptake by plant roots. Substratum material also is very low in organic matter, microbial activity, and major plant nutrients, and it has poor structure or physical properties.

Minimum surface soil after replacement should be approximately 24 inches. However, this figure is a rough estimate, and other factors such as slope, the quality of the spoil material beneath the soil, and the specific nature of the topsoil that is replaced have to be considered. Table 4-1 gives the approximate thickness of soil rated "good" or "fair" that is available on Montana tracts for surface reclamation. This information is not yet available for the Wyoming tracts.

The success of revegetation (reclamation) depends on the ability of the plant communities to perpetuate themselves under the indigenous environmental conditions of an area, such as moisture distribution during the growing season, wind, temperature extremes, and drought. It also depends on the ability of the reclaimed land to meet postmining land use objectives (Coenenberg 1982). The following are the primary points of concern relevant to reclamation:

Reestablishment of any type of vegetation

Reestablishment of forbs, shrubs, and trees

Reestablishment of diverse native plant communities

Topographic and landscape alterations with respect to vegetative reclamation

Attempts at reestablishment of cool-season perennial grasses have met with considerable success (DePuit 1982). The principal problem remaining with this technology is that reestablishment of cool-season grasses often is too successful, to the detriment of attempts at establishing diverse plant communities. Reestablishment of warm-season grasses has been unsuccessful in the past because adapted, good quality seed was lacking, because preparation of seed beds was not sufficient, because planting was not done at optimal times, and because seed was not planted at the proper depths (Ries 1982).

The reestablishment of diverse native plant communities depends largely on initial reclamation practices, especially the use of diverse, locally adapted seed mixtures (Coenenebrg 1982). Shrub establishment generally has not been successful, but the use of planting techniques that introduce slow-establishing plants first improves success in shrub reestablishment (Eddleman 1982). Reestablishment of ponderosa pine has been difficult; however, the use of tubeling stock for transplantation has shown some success. Reestablishment of deciduous trees (cottonwoods and willows) through transplantation and natural revegetation has been successful at some mines.

A reclamation method that aids in successful reestablishment of a diverse plant community is the use of native grass hay mulch rather than an agronomic mulch. Other factors that affect the success of plant community reestablishment are timing of fertilization, grazing practices on revegetated areas, and controlled use of fire (Coenenberg 1982).

Sufficient soil moisture to ensure plant growth at critical times is the major limiting factor influencing plant growth in the Northern Great Plains. The shape of land surface, or topography, controls water movement and influences ground moisture (Wollenhaupt and Richardson 1982). Surface mining normally smooths the landscape and eliminates rugged, diverse topography. Because replacement and recontouring of spoils affect the success of revegetation, careful design of spoils replacement is recommended.

Successful establishment of vegetative cover has been demonstrated at the Dave Johnston, Black Thunder, Belle Ayr, Eagle Butte, Big Horn, Decker, and Rosebud coal mines, to name a few. As a rule, successful reclamation of land disturbed by coal mining depends on the total investment in reclamtion rather than on physical factors. Successful reclamation can be accomplished provided funding is adequate.

Whether a given reclamation project is considered a success or a failure often depends on the desired land use after mining. If the postmining land use is agriculture, the general smoothing of the landscape is beneficial for production of vegetation suitable for livestock or for crop production. If the land is to be used for wildland and wildlife management, the topographic smoothing and loss of vegetative diversity is detrimental.

Existing laws may be contrary to some desired postmining land uses. For example, some state statutes do not allow the reclamation process to leave highwalls, which would be suitable for raptor nesting. Backsloping and recontouring of spoils precludes leaving rugged topography suitable for big game cover. Flatter slopes normally are less prone to erosion, which, if it were allowed to occur, would eventually create rugged topography.

The issue of whether reclaimed land should be managed for agricultural productivity or as wildland is beyond the scope of this document. For the purposes of this EIS, it can be said that mined land can be reclaimed successfully in the Powder River Basin.

TABLE 4-1
ESTIMATED DEPTH OF SOIL RATED GOOD OR FAIR AFTER REPLACEMENT
FOR MONTANA TRACTS
(in feet)

	Alternative				
Tract	2	3	4	5	6
Colstrip Maintenance	2.5	2.5	2.5	2.5	2.5
Colstrip C	2.7	2.7	2.7	2.7	2.7
Spring Creek[b]	0.9	0.9	0.9	0.9	0.9
North Decker I	3.4	3.4	3.4	3.4	3.4
North Decker II	1.5	1.5	1.5	1.5	1.5
Wolf Mountain Maintenace	1.1	1.1	1.1	1.1	1.1
Downey Coulee					1.9
Ashland (Decker-Birney)		2.6	2.6	2.6	2.6
Northwest Otter Creek[a]			1.6	1.6	1.6
Hanging Woman Creek				1.3	1.3
Mud Springs		2.1	2.1		2.1

a. Tract contains 1,333 acres of grazeable woodland, or 25% of

b. Because the soil on this tract is so shallow, replacement of overburden must be selective for reclamation to be successful.

WATER RESOURCES

Groundwater

Mining would impair or destroy 275 to 425 wells and at least 25 to 49 springs, depending on the alternative selected. Mine operations would require 9,340 to 12,590 acre-feet per year by 1995, depending on the alternative. Most of the needed water could be supplied from pit dewatering operations, although additional wells would be required for potable supplies. Population growth would require additional municipal supplies of 11,275 to 17,175 acre-feet per year by 1995, depending on the alternative.

Effects on groundwater would occur primarily within a 2- to 3-mile radius of mined areas (Hasfurther, Akerbergs, and Shafer 1982). Mining would have little effect on regional groundwater systems. Impacts would include removal or modification of aquifers, interruption of groundwater flow during mining, modification of flow after reclamation, and changes in water quality.

New mining of federal coal would result in the removal of the lowest coal aquifer mined and all aquifers above it. Coal beds usually are the most extensive shallow aquifers in the region, whereas sandstone aquifers in the overburden and interburden usually are lenticular beds of relatively small areal extent.

Reclamation regulations require that the overburden and interburden (spoil) be replaced in the mine to restore the area to as nearly its original condition as practical. The replaced spoil is usually moderately permeable unless it is unduly compacted during emplacement. Studies by Rahn (1976) indicate that dragline-laid spoil that undergoes gravity sorting and minimal compaction by machinery may be as much as a hundred times more permeable than scraper-laid spoil, which is compacted by scraper wheels. Aquifers created by dragline-laid spoil can have a higher recharge rate and yield than the combined total of the original aquifers, while scraper-laid spoil aquifers may have lower recharge rates and yield than the original aquifers.

The water-bearing characteristics of spoil laid by truck and shovel are between those of dragline-laid spoil and scraper-laid spoil. Therefore, the impact of removing aquifers in the mined areas can be mitigated by replacing spoil in a manner that will create aquifers with water-bearing characteristics equal or superior to those of the original aquifers.

A mine pit acts as a large well if it extends below the water table. Water entering a pit would be lost through evaporation, consumed in mine operations such as dust suppression, or pumped into streams in dewatering operations. Water discharged from a mine pit would lower the groundwater levels in the vicinity, creating a cone of depression. Pumping of standard wells to supply additional water for mine operations would increase the cone of depression.

The change in the water level surrounding the mine would depend on aquifer characteristics, recharge rates, and pumping rates. The decline would be greatest in the mine itself; it would decrease with distance from the mine edges to negligible amounts within a few miles.

If the cone of depression caused by mining intersected a nearby stream, the hydraulic gradient of the water table could be reversed so that water would move from the stream toward the mine. If this was done, a reduction in streamflow would result, but because of restrictions on mining alluvial valley floors and the generally low permeability of earth materials other than alluvium in the region, the reduction would be less than 1%.

Modification of groundwater flow after reclamation results from breakup of the layering that generally occurs in native formations of the region and from modification of the slope of the land surface. In many parts of the region, relatively impermeable shale layers interbedded with sandstone and coal cause perched zones of saturation to form. Where perching layers outcrop, springs or seeps occur. The replaced spoil is relatively uniform in composition, so that vertical and horizontal permeability are similar. For this reason, in reclaimed areas there are no perched zones with their springs and seeps, and recharge to the water table is increased.

The removal of springs and seeps from their former locations would affect the plants and animals that depend on the additional water at those locations. Springs and seeps might reappear at different locations after the completion of reclamation, or the extra recharge to the water table might discharge into streams. The overall impact of mining would be a permanent change in groundwater flow, but mining would not permanently diminish the quantity of water available in the area of the mine.

The water in the spoil aquifer would be of poorer quality than the water in the original aquifers. This is because the disturbed spoil presents many fresh surfaces to percolating water, and this causes solution of soluble minerals to occur at a higher rate. The solution rate would eventually return to normal levels; however, with the low levels of precipitation and recharge prevalent in the Powder River Region, this process might take many years, perhaps centuries. Contamination of groundwater in spoil aquifers can be mitigated by requiring selective placement of saline spoil above the zone of saturation.

The groundwater occurring naturally in the region varies greatly in mineral content both areally and with depth at a given location. Spoil aquifer water also varies, but it generally is two to three times as mineralized as water from undisturbed coal aquifers. In general, dissolved solids in spoils aquifer water would not exceed 3,000 mg/l. This would be suitable for use by livestock and wildlife. Better quality water would be available from deeper aquifers. However, drilling costs to develop deeper wells would be higher, and pumping lifts and costs would be greater if the mine was in a recharge area.

Surface Water

Surface outflow from the region will be reduced by about 3,113 acre-feet per year by projected coal mining if no new leasing takes place (Alternative 1). Under Alternatives 2 through 6, the surface outflow would be reduced by an additional amount of 303 to 1,085 acre-feet per year. Estimates of the reduction in surface outflow are less than projected increases in water use because much of the water intercepted and consumed by mining would otherwise be dissipated by evaporation losses on site or en route downstream. Table 4-2 summarizes the estimated maximum reductions in flow for major streams. Flow reductions would be too small to have an adverse effect on beneficial uses or aquatic biology of perennial streams.

Between 55 and 179 livestock ponds and small reservoirs would be destroyed by mining under Alternatives 2 through 6. Although the quantity of water lost would not be regionally significant, the loss of watering sources would be a deterrent to use of the area by wildlife and livestock until the sources were replaced during reclamation. However, since only a fraction of the total leased area would be undergoing mining at any one time, only a fraction of the affected reservoirs would be unavailable for use at any one time.

Temporary changes in infiltration rates might slightly affect surface runoff from reclaimed areas. The effect would be short-lived and relatively minor because infiltration on spoils would become similar to infiltration on native rangeland as root systems developed.

Discharge from coal spoils aquifers might contain TDS concentrations two to three times greater than those in undisturbed aquifers (Van Voast and Hedges 1975). This water could be marginal for use by livestock and wildlife. Most of the discharge from spoils aquifers would occur as small springs and seeps in ephemeral stream channels, which would delay and reduce the effect of that discharge on the quality of water in perennial streams.

If no new leasing occurs, the dissolved load of streams in the region will increase as existing mines disturb additional acreage and as projected mines are developed. The effect of new and proposed mines under the "no new leasing" alternative would be to increase TDS concentrations as much as 5.6% in the Cheyenne River, the most heavily affected drainage. In comparison, the increase in TDS in the Tongue River would be a maximum of 1.4% under Alternative 1.

If the maximum amount of leasing took place (Alternative 6), the Tongue River would be most affected by the leaching of mine spoils, with an increase in TDS of as much as 7.2%. This increase could have a small negative impact on beneficial uses of water and downstream aquatic biology; however, it is too small to have a measurable effect on the salinity of the Yellowstone River. Table 4-3 presents the estimated maximum increases in TDS concentrations that would be caused by new mines under each alternative.

TABLE 4-2
ESTIMATED MAXIMUM POTENTIAL REDUCTIONS IN STREAM DISCHARGE
DUE TO NEW AND PROJECTED MINING

	Percentage of Decrease by Alternative					
Stream	1	2	3	4	5	6
Cheyenne River	2.20	3.10	3.10	3.10	3.10	3.80
Belle Fourche River	1.30	1.70	1.70	2.30	2.30	2.30
Little Powder River	2.20	2.20	2.20	2.20	2.20	3.80
Powder River	0.07	0.07	0.07	0.07	0.07	0.07
Tongue River	0.09	0.09	0.12	0.13	0.16	0.44
Rosebud Creek	0.10	0.10	0.10	0.10	0.10	0.19
Armells Creek	1.10	1.10	1.10	1.10	1.10	1.10

TABLE 4-3
ESTIMATED MAXIMUM POTENTIAL INCREASE
IN TOTAL DISSOLVED SOLID CONCENTRATIONS
DUE TO NEW AND PROJECTED MINING

	Percentage of Increase by Alternative					
Stream	1	2	3	4	5	6
Cheyenne River	5.6	6.3	6.3	6.3	6.3	6.9
Belle Fourche River	1.9	2.4	2.4	3.1	3.2	3.2
Little Powder River	2.6	2.6	2.6	2.6	2.6	4.1
Powder River	0.4	0.4	0.4	0.4	0.4	0.4
Tongue River	1.4	1.7	3.5	4.1	4.3	7.2
Rosebud Creek	---	---	---	---	---	2.3
Armells Creek	2.0	4.3	4.3	4.3	4.3	4.3

Sewage effluent would increase in proportion to the quantity of municipal water used. In addition to increased concentrations of dissolved solids, sewage effluents typically contain fecal coliform, suspended solids, nitrates, nitrites, chlorine, ammonia, and orthophosphates. The volume of effluent would increase 28% to 42% by 1990, depending on the alternative selected. Dilution of the effluent would be very low during low flow periods in receiving streams, and some degradation of water quality could be expected locally. However, National Pollutant Discharge Elimination System permits for all discharge must be issued by the appropriate state agencies (the Wyoming Department of Environmental Quality and the Montana Department of Health and Environmental Sciences). Effluent standards stipulated in the permits limit average and maximum levels of pollution discharge to protect the ambient quality and beneficial uses of receiving waters.

There is evidence that concentrations of heavy metals in some spoils leachates are greater than in most natural surface waters, exceeding the recommended maximum concentrations for irrigation on a continuous basis, for livestock use, for public supply, and for aquatic biota (USDI, BLM 1979b). However, the data are not adequate to allow site-specific evaluation of potential hazards.

Requirements for sediment control measures on areas disturbed by mining would result in reduced sediment yields from those areas compared to natural levels (Wyoming statute 35-11 to 35-406; Montana Strip and Underground Mine Reclamation Act [84-4-2 MCA]). However, existing regulations do not apply to off-site disturbances resulting indirectly from coal mining, such as housing construction and related urbanization. Such off-site disturbance could cause sediment yields from construction sites to double for one to two years and then gradually decrease, returning to the predisturbance rate in three to four years. The decreased sediment yield from mined areas would offset increases resulting from urbanization; thus, impacts from increased erosion and sedimentation would be local and short term.

LAND USE

The total acreage used for mining and related activites (rail spurs, access roads, urban growth) under each alternative is shown in table 4-4. Acreages shown for alternatives 3, 4, and 6 include a 600-acre power generation plant on the Mud Springs tract. Table 2-4 in chapter 2 shows the annual rate of disturbance and the maximum acreage disturbed at any one time for each alternative.

It is expected that impacts on private landowners not related to energy would be acceptable, because all landowners involved have indicated a positive preference for mining. Off-site effects such as rail spurs, road relocations, and urban growth could have definite impacts on landowners who do not own property within the tracts. Those impacts could include the removal of a significant amount of an operation from agricultural production or dividing of an agricultural operation into two parts. Such impacts would be addressed in the mine permit application for each tract after proposed spur routes were delineated. However, it should be noted that only five tracts would require a spur line more than 5 miles long. The total mileage of new rail spur required for Alterna-

TABLE 4-4

TOTAL ACREAGE CONSUMED BY COAL MINING AND RELATED LAND USES

Alternative	Acreage Comsumed by Coal Mining and Related Land Uses	Percentage of Increase over Baseline
1 (Baseline)	333,700	—
2	355,700	7%
3	372,000	11%
4	391,300	17%
5	402,800	21%
6	444,800	33%

NOTE: Figures for acreage disturbed include mines or tracts, off-site facilities and transportation corridors, and urban growth. Acreages for Alternatives 2 through 6 are cumulative with baseline figure.

tives 2 through 6 would be 5, 10, 10, 45, and 65, respectively.

Underground utilities, pipelines, and overhead power lines would modify agricultural uses but would not remove a significant amount of acreage from production.

An unavoidable adverse impact that would occur under each alternative would be the disruption of agricultural operations outside the tracts by rail spur lines and urban growth. There would be short-term loss of agricultural productivity on the tracts until the land could be returned to agricultural use. An irreversible and irretrievable effect would be the conversion of agricultural lands to urban uses and permanent transportation facilities (see table 4-4).

WILDLIFE

Alternative 2

Wyoming

The major impacts on big game from Alternative 2 would occur in the Highlight antelope herd unit south of Gillette. These impacts would be caused primarily by new impediments to daily and seasonal movements such as road right-of-way fences and railroad spurs. There also would be impacts from road kills, poaching loss, and habitat loss. About 1.8% of the habitat in the herd unit would be disturbed. Because disturbance would not occur to a large part of the land at any one time, habitat loss caused by the projects included in this alternative would not be significant. With the other impact factors mentioned above included, in the worst case there would be a net loss to the population of 230 antelope over the life of the mines.

There are two golden eagle nests near the Kintz Creek tract, but buffer zones excluded from mining have been established around the nests. There would be some loss of the eagles' hunting habitat, but the impact would be minor.

Seven ferruginous hawk nests are on or within ¼ mile of two of the tracts included in Alternative 2. Special stipulations concerning activities near the nests during the breeding season will be incorporated into the leases if these tracts are leased, as will other mitigating measures. However, even with restrictive stipulations, two nest sites eventually would be destroyed by mining. Since this species normally nests on the ground, alternate nesting sites should be available. The loss of hunting habitat would have moderate negative effects on these birds.

Bald eagles occasionally use the tracts as foraging habitat in the winter. No special habitats such as communal night roosts have been identified on or near any of the Alternative 2 tracts, so no negative impacts would be expected.

Since there are no prairie dog towns on or near any of the tracts included in this alternative, no negative impacts to the black-footed ferret would be likely to occur. Peregrine falcons are only occasional migrants through the area, so there would be no negative impacts on this species.

Montana

Habitat disturbance to BLM planning areas under this alternative would be limited to 0.9% of the Decker area and 0.6% of the Colstrip area. Small portions of antelope winter range would be leased and eventually mined in the Decker area. Development would closely approach some crucial winter range for mule deer near the Wolf Creek tract. The major adverse impacts would be caused mainly by increased poaching and road kills.

Two sharp-tailed grouse leks would be destroyed by the mining of the Colstrip C tract. Sharp-tailed grouse in other parts of the Colstrip area have established new leks on reclaimed areas near active mining operations. Assuming successful reclamation and the establishment of vigorous grass cover, it is likely that the only effect on sharp-tailed grouse would be displacement by mining.

Bald eagles would not be adversely affected by mine extensions in the Decker area. The only potential problem could be the lowering of water quality in the Tongue River Reservoir. The Montana Department of State Lands and OSM require water quality monitoring and water treatment, so negative impacts on water quality, and ultimately on the bald eagle, should not occur.

There is a prairie falcon nest on the Wolf Mountain Maintenance tract over previously leased federal minerals. After consultation with the U. S. Fish and Wildlife Service, the BLM applied an exception to unsuitability criterion 13 of the federal coal management regulations (43 CFR 3461.1) to allow for mining of the site with appropriate mitigation. Mitigation would include retention of highwalls suitable for raptor nesting and expansion or improvement of nesting holes in cliffs. The decision was stated in a September 1, 1982, letter from the BLM's Miles City District Office to the Office of Surface Mining in Denver (letter 3500/MO61686).

Alternative 2 would have no negative impacts on black-footed ferrets or peregrine falcons in Montana.

Alternative 3

Wyoming

Since the same Wyoming tracts are included in Alternative 2 and Alternative 3, the impacts of Alternative 3 in the Wyoming portion of the region would be the same as those described under Alternative 2.

Montana

Impacts from Alternative 3 in the Decker and Colstrip planning areas would be the same as those from Alternative 2. Impacts from leasing of competitive tracts would occur in two different areas; thus, they would not be magnified as they would if the tracts were close together or adjacent.

There are no crucial big game habitats on either the Ashland (Decker-Birney) tract or the Mud Springs tract. The loss of seasonal habitat would amount to 9.3% of the Otter Creek area and 5.5% of the Mud Springs area. The major impacts would be due to increased poaching and vehicle-animal collisions.

Two sharp-tailed grouse leks would be mined on the Ashland (Decker-Birney) tract. Both leks overlie fee minerals, so no unsuitability exclusion has been made. The primary effect would be displacement of the grouse to adjacent undisturbed habitat. Successful reclamation should allow for the continued presence of sharp-tailed grouse after mining.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

The black-tailed prairie dog towns on the Mud Springs tract were surveyed in 1980, but no sign of black-footed ferrets was found; therefore, the mining of the towns would have no known adverse effects on the ferret. The towns would have to be surveyed again just before ground-disturbing activites were initiated.

Alternative 3 would have no negative effects on bald eagles or peregrine falcons in Montana.

Alternative 4

Wyoming

The major impacts of Alternative 4 on big game would occur to antelope in the Highlight herd unit and to antelope, mule deer, and white-tailed deer in the Youngs Creek area. These impacts would include impediment of daily and seasonal movements by right-of-way fences and rail spurs. There also would be impacts from road kills, poaching, and habitat loss.

The total habitat disturbance from development of the tracts included in this alternative would amount to 2.8% of the Highlight herd unit and 0.8% of the antelope hunt area surrounding Youngs Creek. There could be a total net loss of 360 animals in the Highlight herd unit and 20 in the Youngs Creek area through development.

The worst adverse effect on mule deer would occur in the Youngs Creek tract, where destruction of riparian vegetation and of the rocky hillside north of Youngs Creek to the Montana state line would cause loss of cover. The rocky hills along the Belle Fourche River in the Mount Logan tract would be removed, and the topography would be smoother after reclamation. This would permanently lower the value of the area as winter habitat for mule deer, causing an irreversible and irretrievable adverse impact.

White-tailed deer would be most likely to be affected by additional traffic and resultant road kills along the Tongue River valley.

One sage grouse lek and nesting area on the Mount Logan tract would be destroyed, and parts of the nesting areas around two other leks also would be mined. This would have moderately negative impacts on the sage grouse population in southeastern Campbell County.

Mining of the Mount Logan tract under Alternative 4 would affect two more pairs of golden eagles besides those mentioned under Alternative 2. One pair has alternate ground and tree nests at the edge of the tract; the other pair is being manipulated away from the Coal Creek mine east of the tract. The mining company has been trying to lure the birds to an artificial nesting platform and had planned eventually to relocate the birds onto the Mount Logan tract while the Coal Creek mine proceeds to the eastern edge of the Mount Logan tract.

In addition to the ferruginous hawks that would be disturbed under Alternative 2, one more pair would be disturbed under Alternative 4 by the close approach of mining on the Mount Logan tract.

Both pairs of eagles would be affected by disturbance during the nesting season and loss of portions of their hunting territory. A buffer zone surrounding the nest on the northwest portion of the tract will be excluded from mining if the nest is occupied. There is potential for the Coal Creek pair to be adversely affected by the continued manipulation needed to move them again. Provisions for mitigation for both pairs of eagles are described in appendix C.

One pair of prairie falcons on the Youngs Creek tract would suffer some loss of hunting territory. The buffer zone around the cliff nest should be sufficient to provide protection during the nesting season.

The bald eagle pair nesting near the Youngs Creek tract would suffer little or no adverse effects from mining because the buffer zone around their nest protects the riparian corridor along the Tongue River.

The few small black-tailed prairie dog towns on the Youngs Creek tract were surveyed in 1982 for the presence of black-footed ferrets, but none were found. There should be no impact to ferrets if the towns are throughly searched immediately before ground-disturbing activities are begun.

There would be no negative effects on peregrine falcons in Wyoming under Alternative 4.

Montana

The impacts of Alternative 4 would be the same in the Colstrip and Decker areas as those described for Alternative 2, and the same for the Mud Springs area as described for Alternative 3. Impacts in the Otter Creek area would intensify under Alternative 4. A total of 18.6% of the Otter Creek area would be disturbed by mining. No crucial big game habitat would be disturbed; however, the Northwest Otter Creek tract supports a population of mule deer during the winter. They probably would be displaced to adjacent habitat, especially to the Custer National Forest, by development of this tract.

Mining of the Northwest Otter Creek tract would disturb two sharp-tailed grouse leks besides those described for earlier alternatives, making a total of four leks disturbed. This is 20% of the total number of leks found during wildlife baseline surveys in the Otter Creek area. It amounts to 15.7% of the breeding population according to 1980 lek counts.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

Mining near Otter Creek has the potential of causing water degradation. Regulations of the Montana Department of State Lands and OSM should prevent damage to the water quality and to sport fish breeding areas in lower Otter Creek.

Leasing of the competitive tracts in Montana under Alternative 4 would not cause adverse impacts on any federally listed endangered species.

Impacts on endangered species due to the sale of the maintenance tracts are described under Alternative 2.

Alternative 5

Wyoming

The big game species adversely affected by Alternative 5 and the areas of impact would be the same as those described under Alternative 4. The total habitat disturbance from development of the Wyoming tracts in Alternative 5 would amount to 3% of the Highlight antelope herd unit and 2% of antelope hunt area 15. Adverse impacts from development could cause a maximum net loss of 385 antelope in the Highlight herd unit and 60 in area 15.

Development of the Hidden Water tract would adversely affect mule deer because upland cover, in the form of juniper and groves of ponderosa pine, would be removed. Removal of rock outcrops and rock piles would cause loss of topographic cover, and the reclaimed topography would be smoother and less suitable for deer cover. Trees planted on the reclaimed surface would take 15 to 25 years to grow large enough to provide escape and thermal cover. Overall, the carrying capacity for mule deer would be significantly lower for 20 years or more after mining ended. However, in the long term the carrying capacity for mule deer would be only slightly lower than it was before mining.

Two sharp-tailed grouse leks would be destroyed by mining of the Hidden Water tract. The birds probably would be displaced to adjacent unoccupied territory, assuming it would be available. Proper reclamation probably would make the tract suitable for sharp-tailed grouse after mining ended.

Two pairs of golden eagles would be disturbed under this alternative, in addition to those described for Alternative 4. These pairs on or adjacent to the Hidden Water tract would suffer some minor adverse effects through the loss of a small part of their hunting territories.

Mining would destroy a few small black-tailed prairie dog towns on the Hidden Water and Porcupine tracts. U. S. Fish and Wildlife Service personnel surveyed the towns in 1982 but found no sign of black-footed ferrets. Destruction of these towns would have a minor impact, causing the loss of a small portion of potential ferret habitat. The towns would have to be surveyed immediately before ground disturbance began to ensure protection of the ferret.

Alternative 5 would have no adverse effects on bald eagles or peregrine falcons in Wyoming.

Montana

The impacts of Alternative 5 would be the same in the Colstrip and Decker areas as those described for Alternative 2. Adverse impacts on big game under Alternative 5 would be the same as those described for Alternative 4 in the Otter Creek area. The Mud Springs area would suffer no adverse impacts.

Mule deer in the Hanging Woman Creek tract would be adversely affected by the loss of some crucial winter habitat over state-owned coal. The total amount of habitat disturbed would amount to 28% of the Hanging Woman Creek area. The nearness of mining development to crucial winter range could increase stress on deer using the range. Road kills and poaching also would be likely to increase.

Two sage grouse leks in the Hanging Woman Creek tract would be destroyed by mining. A mitigation plan covering their loss has been arranged by the Montana Department of Fish, Wildlife, and Parks and approved by the BLM. Mitigation includes dedication of lands for management of existing population, hunting access, and cost sharing on sage grouse planting and research. The plan is described in the final amendment to the *Powder River Resource Area Management Framework Plan,* (Miles City BLM 1982). If the plan is allowed to lapse, the sage grouse leks and surrounding habitat will be designated unsuitable for mining unless another mitigation plan is developed and agreed upon by the state of Montana and the lessee.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

Degradation of water quality in Hanging Woman Creek would harm the game fishery in the lower portion of the creek and reduce its value as breeding habitat. However, enforcement of Montana and OSM regulations concerning water treatment and erosion abatement should prevent such degradation.

Mining of the Hanging Woman Creek tract would destroy approximately 60 acres of black-tailed prairie dog towns. These towns would have to be surveyed for the the presence of black-footed ferrets immediately before ground-disturbing activities were to begin so that adverse effects on the ferret could be prevented.

Alternative 5 would have no adverse effects on bald eagles or peregrine falcons in Montana.

Alternative 6

Wyoming

Adverse impacts on big game species under Alternative 6 would be the same as those of Alternative 5. Impacts on the Highlight antelope herd unit would be greater than those of Alternative 5, and impacts on the Gillette antelope herd unit (antelope area 17) would be greater than those of the "no action" alternative. They would be caused by right-of-way fences, rail spurs, road kills, poaching, and habitat loss.

The total habitat disturbance from development of the Wyoming tracts in Alternative 6 would be 3.8% of the Highlight antelope herd unit, 2% of antelope area 15, and 1.2% of the Gillette antelope herd unit. The maximum net loss would be 480 antelope in the Highlight herd unit, 60 in area 15, and 190 in the Gillette antelope herd unit.

Development of the Hay Creek and Calf Creek tracts would have only minor adverse effects on mule deer in the Powder River herd unit. Most of the area in both tracts has excellent forage but poor cover. If the railroad spur lines to those two mines should run through the Little Powder River valley, the loss of riparian vegetation would adversely affect the amount of deer cover, and the fencing of the spur line would hinder daily movement.

Under Alternative 6, in addition to the impacts on game birds mentioned for Alternative 5, one sage grouse lek on the Hay Creek tract would be disturbed. The two pairs of golden eagles and two pairs of ferruginous hawks nesting near the Ridgerunner tract would be adversely affected by the loss of some hunting habitat; however, there would be little disturbance of the actual nest sites because they are off the tract.

A large black-tailed prairie dog town on the Ridgerunner tract would be mined under Alternative 6. This would have no significant adverse effect on the black-footed ferret as long as the town was thoroughly surveyed for the presence of ferrets immediately before the beginning of ground disturbance.

Bald eagles in Wyoming would suffer only minor effects from the loss of some hunting habitat. Alternative 6 would have no adverse effects on peregrine falcons in Wyoming.

Montana

The adverse impacts on wildlife in the maintenance tracts in Montana under Alternative 6 would be the same as those described for Alternative 2; impacts in the Mud Springs area would be the same as those of Alternative 3; impacts in the Otter Creek area would be the same as those of Alternative 4; and impacts in the Hanging Woman Creek area would be the same as those of Alternative 5.

Development of the Downey Coulee tract would cause a minor loss of yearlong habitat for mule deer. The total habitat disturbed would be 20.4% of the Greenleaf-Miller coal area. The animals probably would be displaced to adjacent undisturbed habitat. There would be some losses from increased poaching and road kills.

This alternative would cause some a loss of nesting habitat for sharp-tailed grouse, which have a display area near the tract, but the loss would be minor.

Development of the Downey Coulee tract could lower the water quality in Rosebud Creek. This would affect game fish in the lower portion of the creek and in the Yellowstone River below its confluence with Rosebud Creek. However, enforcement of federal and state mining and water quality regulations should preclude water quality degradation.

One golden eagle nest on fee minerals will be disturbed by mining if the lessee is able to carry out suitable mitigation. This would have a minor effect on local eagle populations. Suitable natural nest sites are available near the tract so that the birds could nest away from the mining disturbance.

Alternative 6 would have no adverse effects on endangered species beyond those already described in the previous alternatives.

All Alternatives

Unavoidable Adverse Impacts

Removal of vegetation that provides food and cover for wildlife would be an unavoidable adverse impact under Alternatives 2 through 6. Reptiles, amphibians, small mammals, and nesting songbirds would be destroyed by earthmoving activites. Losses of other wildlife species from poaching and road kills would be unavoidable.

Short-term and Long-term Effects

Losses in Wyoming antelope populations would range from 230 to 480 animals, depending on which alternative was selected. Mule deer in Wyoming would be only slightly affected by any of the alternatives. Big game in Montana would suffer only minor short-term effects under any alternative. Populations would be lowered in the short term, especially in the Highlight antelope herd in Wyoming. The removal of rough topography, which would destroy topographic cover, would cause a long-term minor lowering of mule deer population.

Depending on the alternative chosen, development could destroy as many as six sharp-tailed grouse leks and two sage grouse leks in Montana, and two sharp-tailed grouse leks and two sage grouse leks in Wyoming. The habitat loss and displacement would cause short-term population declines in Montana, and it could contribute to a longer-term population decline in southeastern Campbell County, Wyoming.

From two to seven pairs of golden eagles would suffer new disturbances. Assuming that adequate nesting substrates would be provided during mining and after it ceased, these disturbances would be short term.

The prey base for all raptors and carnivores would be lowered in the short term. If reclamation reestablished native or close to native plant communities, the prey base should return to near premining levels within a few years after the cessation of mining.

The loss of black-tailed prairie dog towns in Wyoming and Montana would have minor long-term effects on the black-footed ferret through a loss of prey base and habitat.

Mining would cause a short-term loss of habitat diversity. In some habitat types, especially the woody riparian type, the loss of diversity could well be a long-term loss, since replacement of microhabitat could take 10 to 30 years.

Irreversible or Irretrievable Effects

Animals lost during the development of new mines in the region would be irretrievably lost. Loss of topographic diversity would cause an irreversible loss of cover for big game (mule deer) and other wildlife, thereby lowering the carrying capacities of reclaimed areas.

CULTURAL RESOURCES

Alternative 1

No cultural resources can be expected to suffer as a result of Alternative 1, since "no new leasing" would negate the possibility of new surface-disturbing activites. Inventory, cataloguing, and salvage or destruction of cultural sites will continue as scheduled on existing mines included in the baseline.

Alternatives 2 through 6

The known number of historic and prehistoric sites that might be affected under Alternative 2 is 48; for Alternative 3, 62; for Alternative 4, 142; for Alternative 5, 189; and for Alternative 6, 253. The individual tract profiles contain descriptions of sites by tract. Although a number of cultural sites are known, until an intensive resource inventory has been done for each tract, no accurate quantification of the potential impacts can be made.

The possible adverse effects on any development, as listed by the Advisory Council on Historic Preservation, are destruction or alteration of all or part of a property; isolation from or alteration of its surrounding environment; or introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting (36 CFR 800.9). Possible effects are not limited to these, and each project must be evaluated to determine effects on specific cultural resources. Cultural resource inventories and compliance required by the Historic Preservation Act of 1966 and Executive Order 11593 must be conducted before any federal action that authorizes surface disturbance is approved.

Salvage of cultural resources allows recovery of a portion of the scientific data present. However, under current research methods and priorities, sitesor potential data within sites that would have been important to future research might be overlooked, and some sites not selected for salvage might be destroyed with recovery of only preliminary data. In this way, valuable cultural resources could be lost.

Increased populations would cause accelerated unauthorized collection and vandalism in sites both inside and outside of the coal lease areas. At present, very few sites have been identified that have not been damaged to some extent, and any increase in vandalism could impair their potential for future research.

VISUAL RESOURCES

Mining and related activities would alter the landscape character and change the visual management class. Silos, conveyors, and facility structures would change the line of the landscape; removal of topsoil and overburden would change form, line, color, and texture of the landscape. Off-site impacts from rail spurs, access roads, and power lines would also change the landscape character.

Most of the area affected under the alternatives is VRM class IV (BLM) or visual quality objective (VQO) "modification" (FS). Some areas of VRM class III and VQO "partial retention" also would be affected. Most areas could be returned to the existing VRM class or VQO rating after reclamation. Some steep slopes, scoria knobs, and areas of highly develped erosion would be smoother and more rounded after reclamation; thus, some variety would be lost and the management rating might be reduced. Because the areas do not have high scenic classifications, mining would have a minimal effect on the scenic quality.

An unavoidable adverse impact would be the dominance of the landscape by mining activities and structures. The rolling terrain of the area would reduce the extent of this impact.

Scenic quality and management classifications would be reduced in the short term, causing a short-term change of affected areas to VRM Class V or to visual quality objective "maximum modification." Reclamation would return most of these areas to their existing classifications in the long term.

An irreversible and irretrievable effect of mining would be the change in the landscape character in areas where rough, steep-sided hills and gullies or scoria knobs were replaced after reclamation by gently rounded slopes. Roads, railroads, or power lines left as permanent structures also would constitute an irreversible impact.

NOISE

The noise-related impacts within the 55 dBA zone would be interference with sleep and work tasks, disruption of concentration, and general annoyance to people who live within these zones along rail lines. These impacts would be most significant along new railroad lines such as the Tongue River Railroad and the Chicago and North Western line.

Table 4-5 shows the number of feet from track centerline to the 55 dBA contour for main lines leaving the region. The distance to the 55 dBA contour on a spur line serving one mine would be 2,000 feet.

The zone around each mine would extend for 1/3 mile to 1 mile. Topography, vegetation, and land use would affect the dissipation of the noise associated with the mines.

AIR QUALITY

Introduction

This section considers the direct effects of mining and end-use facilities and the indirect effects of mining-related development such as population growth and the need for more transportation.

The significant pollutant emissions associated with the development of the tracts and the accompanying secondary growth would be total suspended particulates, nitrogen dioxide, and sulfur dioxide. The effects of emissions of other pollutants would be insignificant and, on a regional scale, virtually unmeasurable (USDI, BLM 1981b).

Mining activities generate significant quantities of TSP and relatively small quantities of nitrogen dioxide, sulfur dioxide, carbon monoxide, nonmethane hydrocarbons, ozone, and lead. Power plants now in the region are significant sources of TSP, nitrogen dioxide, and sulfur dioxide. They emit smaller amounts of other pollutants.

The principal emissions from cities and towns are TSP, nitrogen dioxide, and sulfur dioxide. Vehicular traffic may produce local elevations of carbon monoxide levels, but these emissions are not significant regionally.

This analysis will focus on the impacts of mining on levels of TSP, nitrogen dioxide, and sulfur dioxide. The environmental consequences of these airpollutant emissions would be extensive and complex. The direct consequences related to each tract have been analyzed and reported in individual site-specific analyses prepared by PEDCo Environmental, Inc., for the BLM in 1983.

TABLE 4-5
RAILROAD NOISE--55dBA CONTOUR ZONE
(number of feet from track centerline)

	Alternative					
	1 (baseline)	2	3	4	5	6
Montana						
Miles City (BN)	5,300	5,300	5,800	6,200	5,800	6,500
Wyoming						
Gillette (BN)	7,000	7,000	7,400	7,400	7,800	9,400
Newcastle (BN)	12,000	12,200	12,400	13,600	13,600	14,900
Torrington (BN)	5,800	6,400	6,400	6,800	6,800	7,100
Lusk (C&NW)	5,800	6,400	6,400	6,800	6,800	7,100

BN = Burlington Northern Railroad C&NW = Chicago and North Western

The site-specific analyses are on file in the Casper District office.

Possible Effects in This Region

In order to evaluate the effects of project pollutant emissions it is necessary to know the pre-existing, or background, concentrations of the pollutants. Table 3-5 in chapter 3 shows the background figures used in evaluating the modeling results. The background concentration figures were supplied by the state of Wyoming.

The modeling studies show the potential adverse consequences of maximum development on air quality and indicate the types of effects to be expected, their geographical extent, degree of intensity, and relationship to regulatory standards. This information can be used in selecting a preferred alternative and anticipating its impacts. It can also guide more detailed future evaluation of the selected alternatives and its implementation. However, it must be understood that the modeling studies were limited by various constraints; consequently, the conclusions are subject to limitations.

Only maximum development situations were evaluated, because they are the most important in determining acceptable project limits. However, maximum development results give no quantitive information on average impacts, on minimum development situations, or on frequencies to be expected in the worst, average, best, or any other circumstances.

Visibility Impairment

If the projected Mud Springs plant should be built (Alternatives 3, 4, or 6), two main types of visibility impairment might be of concern in the Powder River region: atmospheric discoloration ("plume blight") and visual range reduction (general haze).

Plume from coal-fired power plants or other sources may be discolored by nitrogen oxide emissions that are converted to nitrogen dioxide in the atmosphere. Atmospheric discoloration due to nitrogen oxide emissions is greatest during periods of stable conditions with light winds following nighttime transport. However, since a plume tends to remain intact during such conditions, the discoloration would be confined to a small streak in the sky.

Increased general haze resulting in visibility reduction is caused primarily by particulate emissions and secondary aerosols, such as sulfates resulting from sulfur dioxide emissions. General haze is greatest during light wind, limited mixing, or stagnation conditions after daytime transport. Under these conditions, conversion of gaseous precursor emissions to secondary aerosols is more rapid. Consequently, an individual plume may not be visible at all, but the general haze formed by regional emissions would cause decreased contrast and loss of clarity in the landscape.

Reduction of visibility in the atmosphere due to pollution is primarily caused by light scattering by particles or by light absorption by particles and gases. Particles suspended in the air reduce visibility, or visual range, by scattering and absorbing light coming from both an object and its background, thereby reducing the contrast between them. Moreover, suspended particles scatter light into the line of sight, illuminating the air between, to further degrade the contrast between an object and its background.

Light scattering by particles is the most important cause of visual reduction, and particulates with diameters from 0.1 to 1.0 microns are the most effective per-unit mass in scattering light. Light absorption by particles also is significant when finely divided carbon particles (soot) are present.

Light absorption by gases also may be important to visibility in the Powder River Region because nitrogen dioxide, which results from the emissions of nitrogen oxide by power plants and other sources, absorbs light. It absorbs light strongly at the blue end of the visible spectrum, while allowing light at the red end to pass through. In the atmosphere it reduces the brightness and contrast of distant objects, causing the horizon, the sky, and white objects to appear pale yellow to reddish-brown.

Congress has recognized the problem of visibility degradation and addressed it for mandatory Class I areas and for various national parks and other such federal lands in the Clean Air Act of 1977. In section 169A(a)(1) of the act, Congress said, "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from man-made air pollution."

The EPA has issued visibility regulations implementing the statute. These regulations protect visibility within Class I areas and with respect to "integral vistas" associated with Class I areas (40 CFR 51.300 et. seq.). An "integral vista" is a view from within a Class I area that is important to the visitor's visual experience of the Class I area itself. No integral vistas have been listed for the Class I area in the Powder River Region.

EPA regulations protect Class I visibility by requiring each affected state to develop a program to assure reasonable progress toward meeting the national goal or remedying existing and preventing future visibility impairment by air pollution. Among other things, the visibility program must require that certain existing major stationary sources of pollution affecting Class I visibility be retrofitted with the best available technology to reduce such impacts. It also must require review of Class I visibility impacts of new major stationary sources of major modifications before a PSD permit can be granted, to ensure that emissions will be consistent with "making reasonable progress toward the national goal."

Neither Montana nor Wyoming has yet amended its state implementation plan to meet the federal Class I visibility management requirements; however, both states have adopted ambient air quality standards governing visibility in general.

Total Suspended Particulates

As part of the technical report prepared by PEDCo, the analysis area was subdivided into six smaller areas. Each subarea was analyzed for the six alternatives for 1990, 1995, and 2000 and for the annual and 24-hour averaging periods. For the purpose of this document, only the results for 1995 are shown. The other results appear in the technical report. Appendix E contains a summary of the methodology used in the analysis.

The year 1995 was chosen as the "worst case" in terms of particulate emissions. The area considered for analysis and the locations of existing and committed mines and the lease tracts are shown in figure E-1, appendix E. Existing mines are producing coal now; committed mines have acquired the requisite operating permits but have not begun operation.

Table 4-6 shows the total TSP that would be expected under each alternative in 1995. The emissions from power plants are shown in table 4-7. There are no other major point sources in the analysis area.

The annual and 24-hour concentrations projected for each alternative in 1995 are displayed in figures 2 through 13 in appendix E.

The maximum TSP concentrations projected for each alternative are shown in table 4-8.

The total annual emissions under each alternative would be within the ambient air quality concentrations, but the concentrations would be very close to the Wyoming primary standard and the federal secondary NAAQS. The projected 24-hour maximum emissions under all alternatives exceed the Wyoming and Montana ambient air quality standards and the federal secondary standard. However, each alternative must be considered individually because one receptor point in an alternative may be the only violation that would occur under that alternative, and it also may be a repetitive violation through all alternatives. The project sources that would cause violations of the 24-hour ambient air quality standards are listed by alternative in table 4-9.

TABLE 4-6
ESTIMATED EMISSION OF TOTAL SUSPENDED PARTICULATES BY 1995 FROM MINING SOURCES
(in tons per year)

Alternative	Existing and Committed Developments	Tracts	Total
1	34,044.8	0	34,044.8
2	34,044.8	5,226.8	39,271.6
3	34,044.8	7,427.2	41,472.0
4	34,044.8	10,305.8	44,350.6
5	34,044.8	12,489.3	46,534.1
6	34,044.8	19,274.7	53,319.5

TABLE 4-7
ESTIMATED EMISSION OF POLLUTANTS FROM POWER PLANTS BY 1995
(in tons per year)

Pollutant	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Total Suspended Particulates						
Existing and Committed Plants	4,634	4,634	4,634	4,634	4,634	4,634
Mud Springs Plant	0	0	1,239	1,239	0	1,239
Total	4,634	4,634	5,873	5,873	4,634	5,873
Sulfur Dioxide						
Existing and Committed Plants	26,695	26,695	26,695	26,695	26,695	26,695
Mud Springs Plant	0	0	10,381	10,381	0	10,381
Total	26,695	26,695	37,076	37,076	26,695	37,076
Nitrogen Dioxide						
Existing and Committed Plants	71,762	71,762	71,762	71,762	71,762	71,762
Mud Springs Plant	0	0	20,696	20,696	0	20,696
Total	71,762	71,762	92,458	92,458	71,762	92,458

TABLE 4-8
MAXIMUM AMBIENT ANNUAL AND 24-HOUR CONCENTRATIONS OF TOTAL SUSPENDED PARTICULATES BY 1995 VERSUS AMBIENT AIR QUALITY STANDARDS
(in micrograms of pollutant per cubic meter of air)

				Ambient Air Quality Standards[a]		
Background	Alternative	Concentration	Total	Federal	Montana	Wyoming
Annual						
15	1	37	52	75 (60)	75	60
	2	42	57			
	3	42	57			
	4	42	57			
	5	42	57			
	6	42	57			
24-hour						
61.5	1	149.5	211	260 (150)	200	150
	2	170.5	232			
	3	170.5	232			
	4	170.5	232			
	5	170.5	232			
	6	170.5	232			

---

[a] Numbers in parentheses denote the federal secondary standard.

TABLE 4-9
SOURCES OF OFFSITE VIOLATIONS
OF STATE 24-HOUR AIR QUALITY STANDARDS BY 1995

Alternative	Existing and Committed Facilities	Tracts Included in Alternatives
1	Belle Ayr Caballo Rojo North Rawhide Eagle Butte Buckskin Bighorn East Decker West Decker	None
2	Mines listed for Alternative 1 Jacobs Ranch Black Thunder	Thundercloud Kintz Creek
3	Mines listed for Alternative 2	Thundercloud Kintz Creek
4	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan
5	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan
6	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan Calf Creek Downey Coulee

NOTE: The Wyoming Department of Environmental Quality does not recognize the validity of the 24-hour prediction process.

Effects by Area

The air quality impact of the alternatives can be summarized if the region is divided into the following six geographical areas.

Southeast of Reno Junction. In the Wyoming area southeast of Reno Junction, the Wyoming 24-hour standard would be violated under Alternatives 2 through 6 around Jacobs Ranch Mine, west of the Black Thunder Mine, and around the Thundercloud tract.

South of Gillette. In the area south of Gillette, Wyoming, the Wyoming 24-hour standard would be violated in 1990, 1995, and 2000 east of Belle Ayr and Caballo Rojo under Alternatives 1 through 6, east of Kintz Creek under Alternatives 2 through 6, and between Mount Logan and Coal Creek under Alternatives 4, 5, and 6.

North of Gillette. In the area north of Gillette, Wyoming, the Wyoming 24-hour standard would be violated in 1990 and 1995 between North Rawhide and Eagle Butte under all alternatives. Violations of the 24-hour standard would occur in 2000 east of Buckskin under all alternatives and in 1995 north of Calf Creek under Alternative 6.

Sheridan-Decker. In the area from Sheridan, Wyoming, to Decker, Montana, there would be marginal violations of the Montana 24-hour standard in the area of the Tongue River Reservoir between the West Decker and East Decker mines in 1990 under Alternatives 4, 5, and 6 and in 1995 and 2000 under all the leasing alternatives.

Colstrip-Ashland. In the area of Colstrip and Ashland, Montana, the Montana 24-hour standard would be violated in 1990 east of Downey Coulee under Alternative 6.

Mud Springs-Hanging Woman Creek. In the vicinity of the Mud Springs and Hanging Woman Creek tracts, no federal or state standard would be violated in any of the analysis years.

It must be noted that the Wyoming DEQ does not recognize the validity of techniques used to predict 24-hour concentrations. Therefore, the federal NAAQS must be used for comparison. That standard would not be violated under any of the alternatives.

TSP Effects on Visibility

The TSP emissions from the facilities consist of relatively large dust particles, larger than the optimum size for visibility degradation. The maximum reduction in visual range resulting from particulate concentrations during the second-worst 24-hour period would be less than 5%. This impact can be considered slight; it is generally accepted that a 5% to 10% reduction in visual range is the threshold of perceptability by human observers, even in simultaneous comparisons. The technical report by PEDCo contains more detailed visibility analysis, including the actual percentage of reduction along several lines of sight.

Sulfur Dioxide and Nitrogen Dioxide

The Mud Springs tract is included in Alternatives 3, 4, and 6. If a coal-fired power plant was built on this tract, as has been proposed in an expression of interest, sulfur dioxide and nitrogen dioxide would be emitted at a constant rate shown in table 4-7.

The most restrictive regulation on sulfur dioxide is the PSD increment for the Class I Northern Cheyenne Indian Reservation. The 24-hour allowable increment consumption for sulfur dioxide in a Class I area is 5 micrograms per cubic meter. The maximum increment consumption for sulfur dioxide is projected to be 2.1 micrograms per cubic meter at the reservation boundary. As the isopleths on figures 14, 15, and 16 in appendix E show, no cumulative impacts from sulfur dioxide would be expected from the combination of the projected Mud Springs power plant and existing sources of that pollutant.

Increased gaseous emissions from increased traffic and population under any alternative would have a negligible effect on gaseous pollutant concentrations.

Unavoidable Adverse Impacts

Coal cannot be produced by surface mining without generating fugitive dust. The impacts of dust from individual mines decrease rapidly beyond the mine boundary. Violations of 24-hour ambient air quality standards would occur under the worst-case meteorological conditions near the Thundercloud, Kintz Creek, Mount Logan, Calf Creek, and Downey Coulee tracts under alternatives that include those tracts.

Short-term and Long-term Effects

Anticipated air quality impacts would constitute a short-term use of the air resource. Insofar as mining under a given alternative might cause or contribute to violations of the state ambient air quality standards (as might occur in the immediate vicinity of some existing and proposed mine clusters) or consume a portion of the PSD increment, there could be a potential restriction on the nearby development of other industrial activities that emit air pollutants. Near the mines, this impact would cease when mining was completed and the areas were reclaimed.

Irreversible and Irretrievable Effects

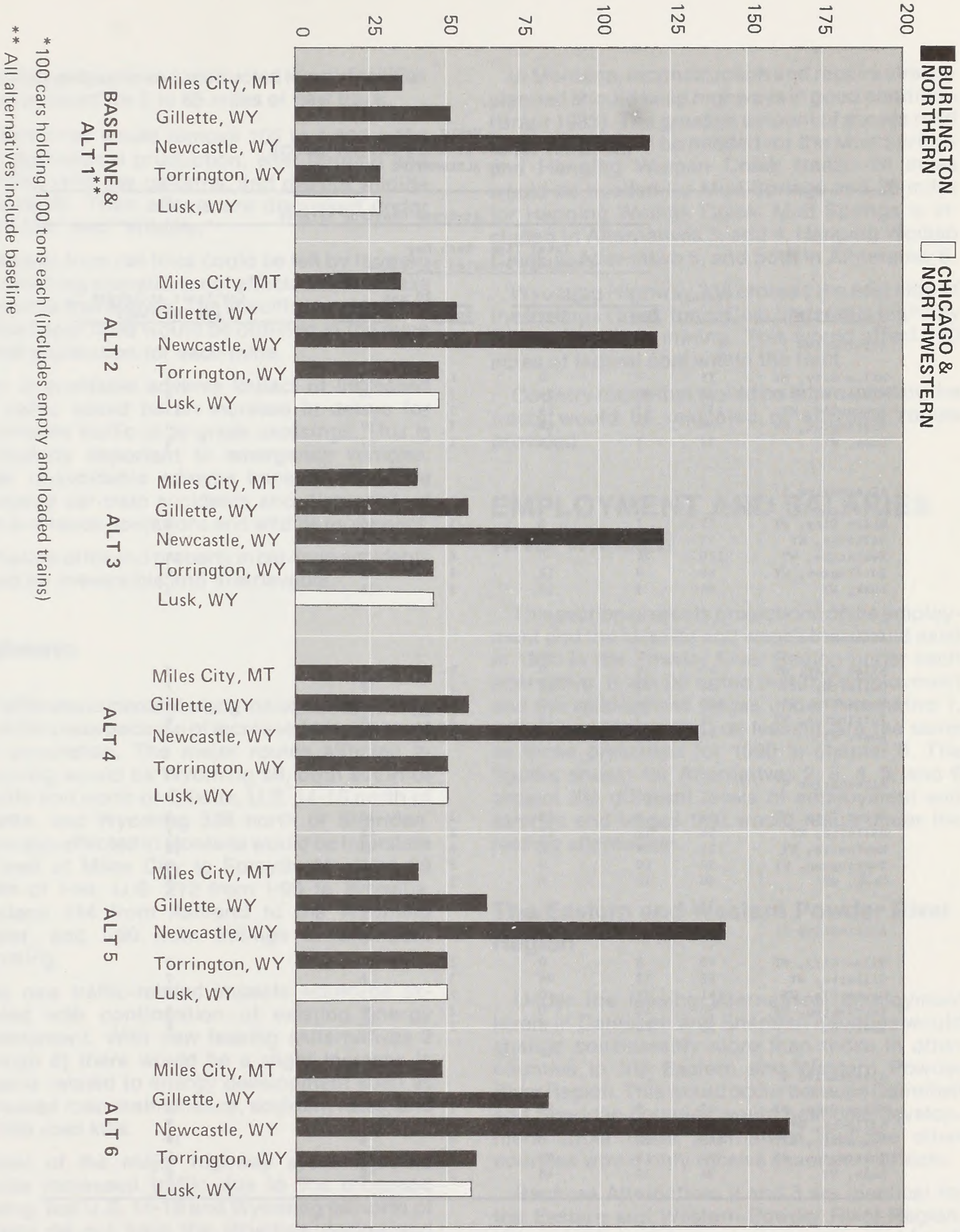
Leasing of federal coal under the alternatives would irreversibly commit a relatively small portion of the region's air resource. After mining and reclamation were completed and the population increments resulting directly and indirectly from mining activities were relocated, it would be possible to retrieve the air resource committment and return the air quality to the current conditions.

TRANSPORTATION FACILITIES

Railroads

Impacts related to railroads would come from two sources: increased main-line traffic and additional spur-line construction. Increased traffic along main lines would disrupt automobile traffic at at-grade crossings for longer periods, raise accident rates at at-grade crossings, and increase noise levels.

Impacts directly to the railroad would be increased maintenance and the need to upgrade switches, sidings, and traffic control devices. The capacity of these lines could be increased to keep up with mining production (Briggs 1981). The projected number of unit trains per day for each alternative in 1995 is shown on figure 4-1. At-grade crossing interruptions and accident rates for selected cities along the main lines leaving the region are shown on table 4-10. These figures are all based on full production potential, which represents maximum development.



*100 cars holding 100 tons each (includes empty and loaded trains)

** All alternatives include baseline

Figure 4-1

PROJECTED UNIT TRAINS/DAY*
BASED ON 1981 FIGURES AND
1995 COAL PRODUCTION POTENTIAL

TABLE 4-10
TRAINS PER DAY AND AT-GRADE CROSSING EFFECTS BY ALTERNATIVE

		At-Grade Crossing Effects				
		Total Time Each Day Crossings Occupied by Trains				
		5 mph		20 mph		
Location	Trains per Day	Hours	Minutes	Hours	Minutes	Car-Train Accidents per 100 Years[a]
Alternative 1						
Miles City, MT	35	7	0	1	45	4
Gillette, WY	52	10	24	2	36	6
Newcastle, WY	117	23	24	5	51	13
Torrington, WY	39		48	1	57	4
Lusk, WY	39	7	48	1	57	4
Alternative 2						
Miles City, MT	35	7	0	1	45	4
Gillette, WY	52	10	24	2	36	6
Newcastle, WY	120	24	0	6	0	14
Torrington, WY	46	9	12	2	18	6
Lusk, WY	46	9	12	2	18	6
Alternative 3						
Miles City, MT	40	8	0	2	0	5
Gillette, WY	56	11	12	2	48	7
Newcastle, WY	122	24	0	6	6	14
Torrington, WY	46	9	12	2	18	6
Lusk, WY	46	9	12	2	18	6
Alternative 4						
Miles City, MT	44	8	48	2	12	5
Gillette, WY	56	11	12	2	48	7
Newcastle, WY	131	24	0	6	33	16
Torrington, WY	50	10	0	2	30	6
Lusk, WY	50	10	0	2	30	6
Alternative 5						
Miles City, MT	40	8	0	2	0	5
Gillette, WY	62	12	24	3	6	7
Newcastle, WY	141	24	0	7	3	17
Torrington, WY	50	10	0	2	30	6
Lusk, WY	50	10	0	2	30	6
Alternative 6						
Miles City, MT	47	9	24	2	21	6
Gillette, WY	82	16	24	4	6	9
Newcastle, WY	162	24	0	8	6	19
Torrington, WY	54	10	48	2	42	6
Lusk, WY	54	10	48	2	42	6

NOTE: Figures for all alternatives are based on production potential. The actual number of trains would depend upon contracts and coal demand.

[a] Based on 1,000 vehicles per day.

Additional spur lines constructed to new facilities would account for 5 to 65 miles of new track.

These lines would remove 105 to 1,365 acres from agricultural production, alter farming and ranching land use patterns, and disrupt wildlife movements. Their effects are discussed under "Land Use" and "Wildlife."

Impacts from rail lines could be felt by farming and ranching operations not affected by the lease properties themselves. The specific impacts from railroad spur lines would be outlined in the mine permit application for each mine.

An unavoidable adverse impact of increased rail traffic would be an increase in delays for automobile traffic at at-grade crossings. This is particularly important to emergency vehicles. Other unavoidable adverse impacts would be increased car-train accidents and disruption of farm and ranch operations and wildlife movement.

The loss of life and property in car-train accidents would be irreversible and irretrievable.

Highways

Traffic would increase along major routes serving the mine areas because of increased employment and population. The major routes affected in Wyoming would be Wyoming 59, both south of Gillette and north of Gillette, U.S. 14-16 north of Gillette, and Wyoming 338 north of Sheridan. Highways affected in Montana would be Interstate 94 west of Miles City to Forsyth, Montana 39 south of I-94, U.S. 212 from I-90 to Broadus, Montana 314 from Ashland to the Wyoming border, and I-90 from Billings to Sheridan, Wyoming.

No new traffic-related impacts would be expected with continuation of existing energy development. With new leasing (Alternatives 2 through 6) there would be a slight increase in impacts related to energy development such as increased road maintenance, accident rates, and wildlife road kills.

Most of the major highway systems could handle increased traffic due to the proposed leasing, but U.S. 14-16 and Wyoming 59 north of Gillette do not have the structure design and alignment to handle large volumes of traffic (Hanlin 1983). These highways would be affected by the Calf Creek and Hay Creek tracts under Alternative 6, with U.S. 14-16 receiving the greater impacts.

In Montana, reconstruction and repairs already planned should keep highways in good condition (Braut 1983). The greatest amount of access road upgrading would be needed for the Mud Springs and Hanging Woman Creek tracts—28 miles would be needed for Mud Springs and 25 miles for Hanging Woman Creek. Mud Springs is included in Alternatives 3, and 4, Hanging Woman Creek in Alternative 5, and both in Altnerative 6.

Wyoming Highway 338 crosses the east side of the Youngs Creek tract. Coal under this highway is unsuitable for mining. This would affect 180 acres of federal coal within the tract.

Country roads that would be interrupted by the tracts would be relocated or alternate routes provided.

EMPLOYMENT AND SALARIES AND WAGES

This section presents projections of the employment and the salaries and wages that would exist in 1990 in the Powder River Region under each alternative. It will be noted that the employment and the salaries and wages under Alternative 1, without additional federal leasing, are the same as those presented for 1990 in chapter 3. The figures shown for Alternatives 2, 3, 4, 5, and 6 project the different levels of employment and salaries and wages that would result under the leasing alternatives.

The Eastern and Western Powder River Region

Under the leasing alternatives, employment levels in Campbell and Sheridan counties would change considerably more than those in other counties in the Eastern and Western Powder River Region. This would occur because Campbell and Sheridan counties would host coal development under these alternatives, but the other counties would only receive secondary effects.

Because Alternatives 2 and 3 are identical for the Eastern and Western Powder River Region, they would result in the same employment for all counties except Sheridan County (see tables 4-11 and 4-12). Employment levels in Sheridan County would differ between the two alternatives because federal coal leasing in the Northern Powder River Region under Alternative 3 would

TABLE 4-11
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR THE EASTERN AND WESTERN POWDER RIVER REGION UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

County/Sector	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Campbell County												
Coal employment	10,500	281.8	11,800	316.7	11,800	316.7	12,400	332.8	12,400	332.9	14,600	391.8
Construction employment	2,100	44.5	2,170	46.0	2,170	46.0	2,230	47.3	2,240	47.5	2,170	46.0
All other employment	11,900	198.6	12,100	202.0	12,100	202.0	12,200	203.6	12,300	205.3	12,600	210.3
All covered employment	24,500	524.4	26,100	564.7	26,100	564.7	26,800	583.7	26,900	585.7	29,400	648.1
Converse County												
Coal employment	990	24.7	990	24.7	990	24.7	990	24.7	990	24.7	990	24.7
Construction employment	610	12.2	620	12.4	620	12.4	620	12.4	630	12.6	850	17.1
All other employment	5,400	95.2	5,500	97.0	5,500	97.0	5,600	98.8	5,600	98.8	5,800	102.3
All covered employment	7,000	132.1	7,100	134.1	7,100	134.1	7,200	135.9	7,200	136.1	7,600	144.1
Crook County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	170	2.9	170	2.9	170	2.9	170	2.9	170	2.9	180	3.0
All other employment	1,430	18.1	1,440	18.2	1,440	18.2	1,460	18.5	1,460	18.5	1,480	18.7
All covered employment	1,600	21.0	1,610	21.1	1,610	21.1	1,630	21.4	1,630	21.4	1,660	21.7
Goshen County												
Mining and construction[a]	310	4.2	310	4.2	310	4.2	320	4.4	320	4.4	320	4.4
All other employment	3,690	36.8	3,700	36.9	3,700	36.9	3,800	37.9	3,800	37.9	3,900	38.9
All covered employment	4,000	41.0	4,000	41.1	4,000	41.1	4,100	42.3	4,100	42.3	4,200	43.3
Johnson County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	250	3.6	250	3.6	250	3.6	250	3.6	250	3.6	250	3.6
All other employment	2,550	29.6	2,580	30.0	2,580	30.0	2,600	30.2	2,600	30.2	2,650	30.8
All covered employment	2,800	33.2	2,830	33.6	2,830	33.6	2,850	33.8	2,850	33.8	2,900	34.4
Natrona County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	3 800	71.3	3 840	72.1	3,840	72.1	3,900	73.2	3,900	73.2	4,000	75.1
All other employment	39,300	683.8	39,800	692.5	39,800	692.5	40,300	701.2	41,100	715.1	41,400	720.4
All covered employment	43,100	755.1	43,600	764.6	43,600	764.6	44,200	774.4	45,000	788.3	45,400	795.5

Niobrara County												
Mining and construction[a]	120	1.8	120	1.8	120	1.8	120	1.8	120	1.8	120	1.8
All other employment	710	6.7	710	6.7	710	6.7	720	6.7	720	6.7	730	6.8
All covered employment	830	8.5	830	8.5	830	8.5	840	8.5	840	8.5	850	8.6
Platte County												
Mining and construction[a]	10	0.2	20	0.5	20	0.5	20	0.5	30	0.5	40	0.5
All other employment	2,990	32.4	3,000	32.5	3,000	32.5	3,100	33.6	3,100	33.6	3,200	34.7
All covered employment	3,000	32.6	3,000	33.0	3,000	33.0	3,100	34.1	3,100	34.1	3,200	35.2
Sheridan County	A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table											
Weston County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	260	4.0	260	4.0	260	4.0	270	4.2	270	4.2	280	4.4
All other employment	3,140	45.6	3,200	46.5	3,200	46.5	3,200	46.5	3,200	46.5	3,300	48.0
All covered employment	3,400	49.6	3,500	50.5	3,500	50.5	3,500	50.7	3,500	50.7	3,600	52.4

NOTE: All employment projections are derived from the Casper District input-output model. All salary and wage projections are based on 1980 average weekly wages as published by the Wyoming Employment Security Commission. Figures may not add due to rounding.

a. Mining and construction have been combined for Goshen, Niobrara, and Platte counties so that individual operations will not be disclosed.

TABLE 4-12
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR SHERIDAN COUNTY UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Coal employment	990	24.9	990	24.9	990	24.9	1,490	37.4	1,840	46.2	1,840	46.2
Construction employment	1,150	18.9	1,160	19.2	1,270	21.0	1,300	21.5	1,230	20.3	1,360	22.5
All other employment	8,060	91.6	8,200	93.1	8,300	94.3	8,500	96.6	8,400	95.4	8,800	100.0
All covered employment	10,200	135.4	10,400	137.2	10,600	140.2	11,300	155.5	11,500	161.9	12,000	168.7
Secondary employment induced in Sheridan County by Montana employment[a]	300	3.6	300	3.6	560	7.2	610	7.8	450	5.6	700	9.1
Montana workers residing in Sheridan County[b]	1,140	32.0	1,140	32.0	2,740	55.6	2,740	55.6	1,340	37.6	2,940	61.2

NOTE: Employment projections are derived from the Casper District input-output model. Salary and wage projections are based on 1980 average weekly wages as published by the Wyoming Employment Security Commission. Figures may not add due to rounding.

a. Estimate of employment induced in Sheridan County by primary employment in neighboring Montana counties. See footnote "b" to table 4-13 for the methodology used in projecting induced employment. Because covered employment is reported by county of employment, these numbers are included in Sheridan County employment.

b. Industrial estimates of the number of Big Horn County coal mine employees living in Sheridan County in 1982 were 50.89% of the estimated 1982 coal employment in Big Horn County. That percentage was used to estimate the number of persons employed in Big Horn County and at the Mud Springs tract in Powder River County who might reside in Sheridan. Because covered employment is reported by county of employment, these numbers are included in Big Horn County and Powder River County employment.

result in an increase in secondary employment in Sheridan County.

In terms of employment levels, Alternatives 4 and 5 also are significantly alike, again in all but Sheridan County. In this instance, however, a coal tract in Sheridan County under Alternative 5 would add to the dissimilarity between the two alternatives.

Predictably, Alternative 6 would provide the highest levels of employment throughout the Eastern and Western Powder River Region. However, when attention is focused on Sheridan County, Alternative 5 clearly presents the best ratio of new jobs in the county to impacts from the Northern Powder River Region.

The Northern Powder River Region

Alternative 6 would provide the highest level of employment in the the Northern Powder River Region, as it would in the Eastern and Western Powder River Region (see table 4-13). For Big Horn and Rosebud counties this would result from secondary effects as much as from coal development. This is partly because there is only one proposed tract in each of those counties and partly because of the level of development proposed for Powder River County. Of the proposed development in Powder River County, construction of the mine-mouth power plant at the Mud Springs tract would have the greatest influence on employment levels. This effect is obvious because employment levels under Alternative 5, in which Mud Springs is not included, are two-thirds lower.

The Crow and Northern Cheyenne Indian Reservations

An opportunity to increase employment and income levels among the Crow and Northern Cheyenne Indians does exist to a limited degree under all the leasing alternatives. Opportunity is obviously greatest under Alternative 6, with the greatest potential in Powder River County because of the greater differences in employment levels between leasing and no leasing. However, without some employment agreement it is not possible to predict the extent to which the Indians would participate in the new employment opportunities. It is therefore assumed that the labor force, employment, and unemployment under all alternatives would remain the same for the Crow and the Northern Cheyenne as projected in the baseline (see table 3-9).

POPULATION AND HOUSING

This section presents projections of population and housing requirements that would exist in 1990 under each of the alternatives in the Powder River Region. As with employment, it will be noted that the population and housing projected under the alternatives without additional federal competitive leasing are the same as those presented for 1990 in chapter 3, and the figures presented under Alternatives 2 through 6 are projections of the different levels of population that would exist under the various leasing levels.

The Eastern and Western Powder River Region

Because of greater employment opportunities under the leasing alternatives, population would increase far more in Campbell County and Sheridan County than in other counties in the Eastern and Western Powder River Region (see tables 4-14 and 4-15). In addition, the population of Sheridan County would be increased even more as a direct result of primary employment in the Northern Powder River Region. Of the persons employed by any primary employment in Big Horn County or on the Mud Springs tract in Powder River County, it is estimated that 50% would reside in Sheridan County.

Because the Mud Springs tract is not included under Alternative 5, the impacts to Sheridan County from development in the Northern Powder River Region would be far lighter under that alternative than under the other leasing alternatives. It also should be pointed out that utilization of the unemployed labor force among the Crow and the Northern Cheyenne Indians would serve to limit population increases in the region, thereby reducing impacts to Sheridan County from development in the Northern Powder River Region.

The Northern Powder River Region

Of the persons employed by new primary employment in Powder River County under the leasing alternatives, it is estimated that about 50% would reside in Rosebud County or Sheridan County. However, Powder River County would

TABLE 4-13
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR THE NORTHERN POWDER RIVER REGION UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

County/Sector	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Big Horn County												
Coal employment[a]	2,240	63.1	2,240	63.1	2,240	63.1	2,240	63.1	2,630	74.0	2,630	74.0
Construction employment[b,c]	420	12.3	420	12.3	540	15.9	560	16.5	490	14.4	600	17.7
All other employment[b]	2,570	27.8	2,570	27.8	2,770	30.0	2,800	30.3	2,650	28.7	2,790	30.2
All covered employment	5,200	103.2	5,200	103.2	5,600	109.0	5,600	109.9	5,800	117.1	6,000	121.9
Powder River County												
Coal employment[a]	440	9.5	440	9.5	780	16.8	1,090	23.5	1,090	23.5	1,090	23.5
Construction employment[b,c]	40	0.5	40	0.5	3,200	47.2	3,200	47.2	40	0.5	3,200	47.2
All other employment[b]	580	6.3	580	6.3	610	6.6	620	6.7	600	6.5	630	6.9
All covered employment	1,100	16.3	1,100	16.3	4,600	70.6	4,900	77.4	1,730	30.5	4,900	77.6
Rosebud County												
Coal employment[a]	1,340	37.5	1,340	37.5	1,340	37.5	1,340	37.5	1,340	37.5	1,540	43.2
Construction employment[b,c]	820	17.3	820	17.3	970	20.5	1,000	21.1	900	19.0	1,050	22.2
All other employment[b]	2,690	26.8	2,690	26.8	2,960	29.6	3,000	30.0	2,830	28.3	3,100	31.0
All covered employment	4,800	81.6	4,800	81.6	5,300	87.6	5,300	88.6	5,100	84.8	5,600	96.4

NOTE: Figures may not add due to rounding.

a. Projections of coal employment are based on the relationship of 1 additional employee for each additional 25,300 tons of projected coal capacity (relationship derived from the Casper District input-output model). Salaries and wages for coal are based on the 1980 weekly average wage for mining.

b. Projected secondary employment is estimated at one additional job in the region for each additional permanent job in energy and 0.5 additional job in the region for each temporary job (as derived from the Casper District input-output model). The secondary employment is then distributed among sectors on the basis of each sector's share of the ten-year (1970-1980) regional change in all employment less mining. The secondary sector change is then distributed to the counties on the basis of each county's share of the ten-year (1970-1980) change in regional employment in that sector. Salaries and wages are projected on the basis of 1980 average weekly wages.

c. Construction projections include construction employment for mines, power plants, and railroads, as applicable, in addition to secondary construction employment. Construction estimates for major projects were obtained from industrial planning and environmental impact statements.

TABLE 4-14
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR THE EASTERN AND WESTERN POWDER RIVER REGION

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
County/Community	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Campbell[a]	45,600	17,800	48,400	18,900	48,400	18,900	50,000	19,500	50,100	19,500	54,700	21,300
Gillette	22,700	9,100	24,100	9,600	24,100	9,600	24,900	10,000	24,900	10,000	27,200	10,900
Converse[b]	16,700	6,400	16,900	6,400	16,900	6,400	17,200	6,500	17,200	6,500	18,100	6,900
Douglas	7,100	2,800	7,200	2,800	7,200	2,800	7,300	2,830	7,300	2,830	7,700	2,990
Glenrock	3,250	1,240	3,300	1,260	3,300	1,260	3,300	1,260	3,400	1,300	3,500	1,340
Crook[c]	5,800	2,660	5,900	2,710	5,900	2,710	5,900	2,710	5,900	2,710	6,000	2,750
Sundance	1,190	520	1,200	530	1,200	530	1,210	530	1,210	530	1,230	540
Moorcroft	1,110	480	1,120	490	1,120	490	1,130	490	1,130	490	1,150	500
Goshen[c]	14,600	6,100	14,800	6,200	14,800	6,200	15,000	6,300	15,100	6,300	15,500	6,500
Torrington	6,600	2,700	6,700	2,750	6,700	2,750	6,800	2,790	6,800	2,790	7,000	2,870
Johnson[c]	8,100	3,700	8,200	3,700	8,200	3,700	8,200	3,700	8,300	3,800	8,400	3,800
Buffalo	4,600	2,020	4,700	2,070	4,700	2,070	4,700	2,070	4,700	2,070	4,800	2,110
Natrona[c]	83,800	33,200	84,900	33,700	84,900	33,700	85,900	34,100	87,400	34,700	88,300	35,000
Casper	59,500	23,600	60,300	23,900	60,300	23,900	61,000	24,200	62,100	24,700	62,700	24,900
Niobrara[c]	3,200	1,570	3,220	1,580	3,220	1,580	3,240	1,590	3,250	1,590	3,300	1,620
Lusk	1,800	850	1,810	850	1,810	850	1,820	860	1,830	860	1,860	880
Platte[c]	9,200	3,900	9,400	4,000	9,400	4,000	9,500	4,000	9,500	4,000	9,800	4,100
Guernsey	1,530	670	1,560	680	1,560	680	1,580	690	1,590	700	1,630	710
Wheatland	4,500	1,950	4,600	1,990	4,600	1,990	4,600	1,990	4,700	2,030	4,800	2,080
Sheridan: A separate table has been prepared for Sheridan County. See table 4-												
Weston[c]	9,900	4,000	10,000	4,100	10,000	4,100	10,100	4,100	10,100	4,100	10,300	4,200
Newcastle	5,000	2,010	5,100	2,050	5,100	2,050	5,100	2,050	5,100	2,050	5,200	2,090
Upton	1,660	730	1,680	740	1,680	740	1,690	740	1,690	740	1,720	760

NOTE: Projections were derived by applying 1980 population-to-employment ratios to projected employment. City projections are based on the 1980 city-to-county ratio. Housing requirements are based on the number of persons to house in 1980.

a. For Campbell County, a ratio of 1.888 was used for permanent employment, plus 1.209 for temporary employment.

b. For Converse County, a ratio of 2.3721 was used for permanent employment, plus 1.209 for temporary employment.

c. Ratios applied for all employment in each county are as follows: Crook, 3.681; Goshen, 3.636; Johnson, 2.932; Natrona, 1.943; Niobrara, 3.868; Platte, 3.097; Weston, 2.981.

TABLE 4-15
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS FOR SHERIDAN COUNTY

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]
Primary impact of Montana employment	3,300	1,440	3,300	1,440	5,200	2,270	5,200	2,270	3,900	1,700	5,800	2,530
Secondary impact of Montana employment	800	350	800	350	1,560	680	1,710	750	1,230	540	1,950	850
Base without Montana impacts[c]	28,500	12,400	28,900	12,600	28,900	12,600	30,700	13,400	31,800	13,900	32,500	14,200
County total	32,600	14,200	33,000	14,400	35,700	15,600	37,600	16,400	36,900	16,100	40,300	17,600
City of Sheridan	19,700	8,600	19,900	8,700	21,600	9,400	22,700	9,900	22,300	9,700	24,300	10,600

a. Projections of total Sheridan County population are based on the 1980 population-to-employment ratio of 2.8997 for permanent employment, plus 1.2085 for temporary employment. Estimates of primary and secondary impacts to Sheridan County due to Montana employment were made after the population-to-employment ratio was modified by alternately adding and subtracting Montana employment and its effects from Sheridan County employment and population in each projected year. City population is projected at its 1980 share (60.47%) of county population.

b. Housing projections are based on 1980 ratio of 2.292 persons per house for the county and 2.293 persons per house for the city.

c. Base population and housing were derived by subtracting primary and secondary impacts from the total.

bear the largest increase in population in either relative or absolute terms (see table 4-16). Under Alternative 5, in which the Mud Springs tract is not included, the magnitude of the increase would be reduced, but it would still be substantial.

The Crow and Northern Cheyenne Indian Reservations

Table 4-17A presents the population levels with housing requirements that would exist on the Crow and Northern Cheyenne Indian reservations under the alternatives. For table 4-17A, it is assumed that on a "worst case" basis the increases would occur in the non-Indian segments of the populations. This effect would be reduced with increased Indian participation in employment opportunities.

Alternate "Scenario" for the Northern Cheyenne Reservation

Because of concern that the population distribution to the Northern Cheyenne Reservation (as presented in tables 4-16 and 4-17A) might prove invalid, a separate population distribution was prepared for the Northern Powder River Region under an alternative "scenario." To accomplish the alternative analysis, a group of individuals who are knowledgeable of the area, including three very knowledgeable members of the Northern Cheyenne Tribe, performed a distribution of primary employment by place of residence. It should be noted, however, that the Northern Cheyenne Tribe does not endorse the validity of this analysis.

A major assumption in the alternative "scenario" is the participation of the Northern Cheyenne in the new employment opportunities, implying that some preferential employment agreement might be in effect.

In addition, the following considerations and assumptions were major factors in the alternative analysis.

There are high schools at Forsyth, Colstrip, Broadus, and Ashland and there are elementary schools in the same communities and in Lame Deer.

Colstrip has new, well-developed community services.

Ashland has sewer capacity for a community of 2,500.

Broadus, which is the county seat of Powder River County, has a relatively well-developed infrastructure.

Broadus is a secondary trade center for Powder River and Rosebud counties.

There is school bus between Ashland and Broadus.

There is excess housing capacity at Colstrip, and Colstrip is no longer a company town; therefore, open development is now possible.

There is contracted bus service from the reservation to Colstrip, although its future is uncertain at present.

Lame Deer has its own utility company.

The population influx into Powder River County would locate in Broadus and on other developments along the transportation corridors (Assumption).

There is much BLM and FS land in the Ashland vicinity; therefore, the limited land for expansion is relatively high-priced when compared to lands on the reservation.

Tongue River Railroad could require land in the Ashland area at the expense of expansion opportunities; however, there is an alternate route.

There is limited housing in the Ashland area both on and off the reservation.

One or two trailer courts are now planned for the Ashland area, both on and off the reservation.

Housing will be built to accommodate the population influx (Assumption).

Living on reservation has advantages: no property taxes, fewer restrictions, it is more scenic (Assumption).

There are non-Indians living on the reservation and working off-reservation at present.

Non-Indians can purchase deeded land on the reservation.

Approximately 25% of the Northern Cheyenne Reservation is deeded.

Indians can get a 2.5-acre life estate for a building that can be leased (renewable) to non-Indians for 25 years.

Distances, weather, and road conditions (present and future) have been considered.

3The road between Kirby and Decker will be oiled (Assumption).

TABLE 4-16

1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS FOR THE NORTHERN POWDER RIVER REGION

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Big Horn County[a]	15,600	5,400	15,600	5,400	16,600	5,800	16,700	5,800	17,200	6,000	17,900	6,200
Crow Reservation Div.[b]	7,900	2,430	7,900	2,430	8,400	2,580	8,500	2,610	8,700	2,670	9,100	2,800
Hardin Division[b]	6,000	2,450	6,000	2,450	6,400	2,620	6,400	2,620	6,600	2,700	6,900	2,820
Hardin[b]	4,600	1,900	4,600	1,900	4,900	2,020	4,900	2,020	5,100	2,100	5,300	2,180
Northern Cheyenne Div.[b]	1,420	400	1,420	400	1,510	430	1,520	430	1,570	450	1,630	460
Tongue River Division[b]	270	150	270	150	290	170	290	170	300	170	310	180
Powder River County[c]	4,640	2,070	4,640	2,070	7,500	3,340	8,200	3,650	6,100	2,720	8,200	3,650
Broadus Division[b]	2,430	1,130	2,430	1,130	3,900	1,810	4,300	1,990	3,200	1,480	4,300	1,990
Broadus[b]	1,320	620	1,320	620	2,130	1,000	2,310	1,090	1,740	820	2,340	1,100
East Powder River Div.[b]	1,340	560	1,340	560	2,170	910	2,350	980	1,770	740	2,380	990
Otter Division[b]	870	380	870	380	1,410	620	1,530	670	1,150	500	1,550	680
Rosebud County[d,e]	14,500	5,500	14,500	5,500	16,200	6,200	16,900	6,500	16,200	6,200	18,000	6,900
Ashland Division[b,e,f]	830	370	830	370	1,410	620	1,900	840	1,860	820	1,960	860
Ashland[b,e,f]	610	190	610	190	1,170	360	1,660	510	1,630	500	1,700	520
Forsyth Division[b]	5,100	2,140	5,100	2,140	5,600	2,340	5,600	2,340	5,400	2,260	6,000	2,510
Forsyth[b]	3,700	1,530	3,700	1,530	4,000	1,650	4,100	1,690	3,900	1,610	4,300	1,770
Northern Cheyenne Div.[b]	3,900	1,120	3,900	1,120	4,200	1,200	4,300	1,230	4,100	1,170	4,600	1,320
Rosebud Division[b]	4.600	1,900	4,600	1,900	5,000	2,070	5,100	2,110	4,800	1,980	5,400	2,230
Colstrip[b]	2,160	700	2,160	700	2,350	760	2,380	770	2,260	730	2,530	810

NOTE: Figures may not add due to rounding.

a. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.992 was used for permanent employment, plus 1.256 for temporary employment.

b. Projections are based on the 1980 share of county population, except for Ashland and the Ashland district of Rosebud County. It is expected that some of the workforce for the Ashland (Decker-Birney) and Northwest Otter Creek tracts (in Powder River County) would live in Rosebud County; accordingly, projections for those areas include the population effect of 50% of the workforce from those tracts.

c. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 4.367 was used for permanent employment, plus 1.263 for temporary employment. As there was no apparent temporary population in Powder River County in 1980, the average of the temporary ratios for Rosebud and Big Horn counties was used for Powder River County. Fifty percent of the workforce from the Ashland (Decker-Birney), Northwest Otter Creek, and Mud Springs tracts was excluded from these computations so that population effects could be allocated to Rosebud and Sheridan counties.

d. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.997 was used for permanent employment, plus 1.270 for temporary employment. Population effects of the workforce from the Ashland (Decker-Birney) and Northwest Otter Creek tracts were then added to Ashland, Ashland Division, and the county total.

e. Includes population impacts resulting from 50% of the work force on the Ashland (Decker-Birney) and Northwest Otter Creek tracts.

f. Not to be confused with the Ashland District of the Northern Cheyenne Reservation.

TABLE 4-17A
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
Crow Reservation	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Indian	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090
Non-Indian[a,b]	2,770	1,420	2,770	1,420	3,300	1,700	3,300	1,700	3,600	1,850	4,000	2,050
Reservation total[a,b,c]	8,200	2,520	8,200	2,520	8,700	2,790	8,700	2,790	9,000	2,940	9,400	3,140
Lodge Grass[e]	1,060	300	1,060	300	1,120	330	1,130	330	1,160	340	1,210	340
Northern Cheyenne Reservation												
Indian	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040
Non-Indian[a, b]	810	470	810	470	1,240	720	1,310	760	1,140	660	1,680	980
Reservation total[a,d]	5,300	1,510	5,300	1,510	5,700	1,760	5,800	1,800	5,600	1,700	6,200	2,020
Ashland (on reservation)[e]	540	160	540	160	580	190	590	190	570	180	630	210
Birney (on reservation)[e]	210	60	210	60	230	10	230	10	220	10	240	10
Busby[e]	1,170	330	1,170	330	1,270	390	1,280	400	1,240	370	1,360	440
Lame Deer[e]	2,890	820	2,890	820	3,100	960	3,200	980	3,100	930	3,360	1,100

NOTE: Figures may not add due to rounding.

a. Population increases were derived by applying the reservation's share of county population in 1980 to the projected change in county population; however, the Northern Cheyenne Reservation's share of county population was not applied to the portion of the population effect of the Ashland (Decker-Birney) and Northwest Otter Creek tracts that was allocated to Ashland (off reservation).

b. Housing projections are based on the number of persons per house in 1980.

c. Includes the portion of the Crow Reservation in Yellowstone County, Montana. This portion was held constant for the projections.

d. Reservation housing is the sum of Indian and non-Indian housing.

e. Community population projections are based on the community's share of reservation population in 1980. Community housing is based on the community's share of reservation housing in 1980.

There will be a new road built between Decker and the Mud Springs tract (Assumption).

Interstate 90 will be completed between Lodge Grass and Sheridan.

The workforce for the construction of Colstrip 3 and 4 will no longer be in place for the construction of projects after 1988.

Because of the construction and operation of Colstrip, there is a trained Indian workforce in existence.

Ten percent of the construction workforce would consist of Indians (Assumption).

Fifteen percent of the operations workforce would consist of Indians (Assumption).

Ten percent of new Indian hires would be from outside of the region (Assumption).

Fifty percent of new Indian hires would be from unemployed reservation Indians (Assumption).

Fifty percent of new Indian hires would relocate to the reservation (Assumption).

Lame Deer would contribute the largest number of Northern Cheyenne workers (Assumption).

Hiring for Montana construction and operations would be through Billings union halls (Assumption).

Construction of the proposed Mud Springs power plant would result in an on-site labor camp being constructed (Assumption).

On the basis of distance, road systems, and historical experience in the Decker mines, it is assumed that 50% of the operations workforce and 33% of the construction workforce from Mud Springs and Hanging Woman would reside in Sheridan County, Wyoming (Assumption).

The locations and kinds of regional secondary employment generated by these actions would occur in the same patterns as in the 1970-1980 period (Assumption).

Indian participation in secondary employment would be negligible (Assumption).

The population level resulting from both primary and secondary employment would occur at the same county population-to-employment ratios that existed in 1980. (Assumption)

Population resulting from primary employment would be distributed in the same pattern as the distribution of primary employment by place of residence (see table 4-17B) (Assumption).

Population from secondary employment would be distributed in the same pattern that existed in 1980.

Table 4-17B presents the alternative distribution of primary employment by place of residence, and table 4-17C presents the resulting distribution of population. The major differences between the alternate population distribution (table 4-17C) and the original (tables 4-16 and 4-17A) are the shift of population increases from Sheridan County to Yellowstone County and the increase in the Indian segment of the reservation population under the alternatives. Both of these changes are predictable under the new assumptions. However, it must be noted that the total populations projected for the Northern Cheyenne Reservation under the alternate "scenario" (table 4-17C) varied only marginally from the original analysis (tables 4-16 and 4-17A)—the maximum difference was 6.8% under Alternative 5.

In addition, the results of comparing, or ranking, the alternatives on the basis of reservation population remain the same for both population distributions. Inasmuch as expenditure levels and community services and facilities would vary directly with population levels, it would not be productive to carry the alternate "scenario" any further in this document.

REVENUES AND EXPENDITURES

This section presents a comparison of potential revenues to peak expenditures in the Powder River Region under the alternatives. The absolute magnitude of the revenues or expenditures should not be emphasized. This analysis is based on relative change as an indicator of potential costs versus potential benfits. All expenditures are projected on the basis of 1980 per capita spending levels.

It will be noted that expenditures under the alternatives that do not propose additional federal competitive leasing are the expenditure levels projected for 1990 in chapter 3. Without additional federal competitive leasing, it is assumed that funding will equal expenditures through taxation, user fees, grants, or deficit spending.

As we stated in chapter 3, it must be assumed that localities that cannot utilize these measures

TABLE 4-17B
DISTRIBUTION OF PRIMARY EMPLOYMENT WITH INDIAN PARTICIPATION
BY PLACE OF RESIDENCE BASED ON JUDGMENTAL WEIGHTING
(projections for all alternatives are for 1990)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Northern Cheyenne Reservation						
Ashland (on reservation)						
Indian	---	---	85	94	35	115
Non-Indian	---	---	105	146	102	167
Busby						
Indian	---	---	45	54	27	72
Non-Indian	---	---	20	25	14	39
Lame Deer						
Indian	---	---	170	188	65	230
Non-Indian	---	---	40	49	27	82
Birney Village						
Indian	---	---	30	39	27	47
Non-Indian	---	---	---	---	---	---
Reservation total						
Indian	---	---	330	375	154	464
Non-Indian	---	---	165	220	143	288
Rosebud County						
Ashland (off reservation)	---	---	195	263	174	304
Colstrip	---	---	85	108	64	229
Birney	---	---	20	25	14	29
Forsyth	---	---	---	---	---	15
County total	---	---	730	912	508	1,218
Powder River County	---	---	975	1,089	324	1,174
Big Horn County						
Hardin	---	---	40	40	---	40
County total	---	---	105	119	41	151
Billings	---	---	500	500	---	500
Sheridan County	---	---	830	830	167	997
Grand total			3,140	3,450	1,040	4,040
Indian	---	---	330	375	154	464
Non-Indian	---	---	2,810	3,075	886	3,576

TABLE 4-17C
ALTERNATE POPULATION DISTRIBUTION
BASED ON INDIAN PARTICIPATION IN PRIMARY EMPLOYMENT OPPORTUNITIES AND JUDGMENTAL WEIGHTING OF THE RESULTING PRIMARY EMPLOYMENT DISTRIBUTION
(projection for all alternatives are for 1990)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Northern Cheyenne Reservation[a]						
Ashland (on reservation)						
Indian	460	460	520	540	510	570
Non-Indian	80	80	290	420	390	480
Busby						
Indian	950	950	990	1,000	990	1,030
Non-Indian	220	220	260	280	260	320
Lame Deer						
Indian	2,480	2,480	2,610	2,630	2,580	2,700
Non-Indian	410	410	490	520	500	520
Birney Village						
Indian	180	180	210	220	220	240
Non-Indian	30	30	30	30	30	30
Reservation total	5,300	5,300	5,890	6,130	5,980	6,470
Indian	4,500	4,500	4,750	4,820	4,730	4,950
Non-Indian	810	810	1,140	1,310	1,250	1,520
Rosebud County						
Ashland (off reservation)	610	610	1,000	1,210	1,140	1,340
Colstrip	2,160	2,160	2,360	2,440	2,380	2,820
Birney[b]	200	200	240	260	250	270
Forsyth	3,700	3,700	3,790	3,810	3,750	3,880
County total	14,500	14,500	15,740	16,250	15,880	17,080
Powder River County	4,640	4,640	6,320	6,820	6,080	7,200
Big Horn County						
Hardin	4,600	4,600	4,720	4,730	4,640	4,750
County total	15,600	15,600	15,920	15,980	15,770	16,100
Yellowstone County						
Billings[c]	82,600	82,600	85,330	85,670	83,740	86,320
County total[d]	133,600	133,600	137,630	138,180	135,450	139,230
Sheridan County[e]	32,600	32,600	34,240	34,350	33,440	35,020

NOTE: Figures may not add due to rounding.

[a] Indian and non-Indian estimates for Alternatives 1 and 2 (1990 baseline) are based on the 1980 share of reservation population.

[b] Birney population is based on 1980 population of 136 (Montco Mine draft EIS) and a 1.4% share of 1980 county population.

[c] Alternatives 1 and 2 (1990 baseline) are based on 1980 share of county population.

[d] Alternatives 1 and 2 (1990 baseline) are based on 1980 census of 108,035 and an assumed growth rate of the prior ten years (1970-1980).

[e] This analysis does not include the effects on Sheridan County from Wyoming coal development.

will forgo new or additional facilities or services. In cases where services and facilities are already considered inadequate, it must be further assumed that additional needs will further aggravate an already bad situation.

The Eastern and Western Powder River Region

It is assumed that, in the worst case, all counties in the Eastern and Western Powder River Region that would not host coal development would experience increases in expenditures due to secondary population increases; however, they would not participate in revenue increases from coal production (see table 4-18). It is also assumed that the communities in the vicinity of coal development would not benefit from increases in coal property tax revenues and therefore would experience a shortfall in revenues (after an initial increase in returns from sales and user taxes during the construction of mines). All shortfalls would require additional taxation, user fees, or grants.

In addition, it is assumed that a lag of one year would occur between initial spending increases and initial revenue increases for Campbell and Sheridan counties and their respective school districts.

As can be seen on table 4-18, Campbell County and Campbell County School District 1 should experience a relative abundance of funding under all the alternatives. Sheridan County, however, would experience this abundance only under Alternative 5 or 6. Sheridan County schools would enjoy this abundance under Alternative 4 as well as under Alternatives 5 or 6. It should be pointed out that, because of the lower level of impacts from coal development in the Northern Powder River Region, Alternative 5 presents the best ratio of funding to expenditures in Sheridan County.

The Northern Powder River Region

Table 4-19 presents a comparison of potential revenues to estimated peak expenditures in the Northern Powder River Region under the alternatives. Estimates of revenues for counties and schools are based on the gross proceeds tax and property taxes. The taxable value of gross proceeds is 45% of the contract value of coal (estimated at $7.83 per ton of coal production). The taxable value of coal property is 11% of the market value of the property (estimated at $5 million per million tons of production capacity).

The Mud Springs power plant would be an additional source of property tax revenue for Powder River County and Powder River County schools. The taxable value of power plant property is 15% of the market value, which is estimated at $200,000 per megawatt of production capacity for this analysis.

The county levy for Big Horn County in 1980 was 38.28; the mill levy for Rosebud County schools in 1980 was 78.45. For purposes of this analysis, these levies were used for all counties and schools in the Northern Powder River Region.

Communities in the Northern Powder River Region would not benefit from gross proceeds or property tax revenues; instead, they would find it necessary to petition the Montana Coal Board for revenues.

It is assumed that the revenue changes under the alternatives would lag by a minimum of one year. In the case of Big Horn County, Big Horn County schools, Rosebud County, and Rosebud County schools, and in all cases under Alternative 5, peak revenues would occur in 1991. For Powder River County and Powder River County schools, only about one-third of the increase would occur in 1991 under Alternative 3, and only about one-half would occur in 1991 under Alternative 4 or 6. The full increases would be realized by 1993 in Powder River County under Alternative 3, 4, or 6.

The Crow and Northern Cheyenne Indian Reservations

Table 4-20 presents a comparison of potential revenues and expenditures on the reservations under the alternatives. Although the tribes would experience increased expenditures, they would not participate in increased revenues from gross proceeds or property taxes. Therefore, they would find it necessary to petition the Montana Coal Board for grants.

TABLE 4-18
POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE
IN THE EASTERN AND WESTERN POWDER RIVER REGION

(in thousands of dollars, rounded to the nearest $100,000)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Campbell County						
Revenues	26,900	32,500	32,500	35,200	35,200	45,300
Expenditures	26,900	28,500	28,500	29,500	29,500	29,500
School District 1						
Revenues	70,600	80,200	80,200	85,000	85,000	102,500
Expenditures	70,600	74,800	74,800	77,300	77,400	77,400
Gillette						
Revenues	20,000	20,600	20,600	20,900	20,900	22,100
Expenditures	20,000	21,200	21,200	21,900	21,900	21,900
Converse County						
Revenues	10,500	10,500	10,500	10,500	10,500	10,500
Expenditures	10,500	10,600	10,600	10,800	10,800	11,300
School District 1						
Revenues	19,300	19,300	19,300	19,300	19,300	19,300
Expenditures	19,300	19,500	19,500	19,800	19,800	20,900
Douglas						
Revenues	8,400	8,400	8,400	8,400	8,400	8,400
Expenditures	8,400	8,500	8,500	8,600	8,600	9,000
School District 2						
Revenues	7,200	7,200	7,200	7,200	7,200	7,200
Expenditures	7,200	7,300	7,300	7,400	7,400	7,800
Glenrock						
Revenues	1,500	1,500	1,500	1,500	1,500	1,500
Expenditures	1,500	1,600	1,600	1,600	1,600	1,700
Crook County						
Revenues	3,900	3,900	3,900	3,900	3,900	3,900
Expenditures	3,900	3,900	3,900	3,900	3,900	4,000
School District 1						
Revenues	5,100	5,100	5,100	5,100	5,100	5,100
Expenditures	5,100	5,200	5,200	5,200	5,200	5,300
Sundance						
Revenues	600	600	600	600	600	600
Expenditures	600	600	600	600	600	600
Moorcroft						
Revenues	400	400	400	400	400	400
Expenditures	400	400	400	400	400	400

NOTE: Debt servicing is included.

Revenues: It is assumed that revenues under Alternative 1, without additional competitive federal leasing, will equal expenditures through taxation, user fees, grants, or debt. Revenue increases under Alternatives 2, 3, 4, 5, and 6 were derived from Stinson's coal revenue model.

Expenditures: All expenditures are projected on the basis of 1979 per capita expenditures.

(continued on next page)

REVENUES AND EXPENDITURES--EASTERN AND WESTERN POWDER RIVER REGION (continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Goshen County						
Revenues	2,300	2,300	2,300	2,300	2,300	2,300
Expenditures	2,300	2,400	2,400	2,400	2,400	2,500
School District 1						
Revenues	9,500	9,500	9,500	9,500	9,500	9,500
Expenditures	9,500	9,700	9,700	9,800	9,900	10,100
Torrington						
Revenues	5,100	5,100	5,100	5,100	5,100	5,100
Expenditures	5,100	5,200	5,200	5,300	5,300	5,400
Johnson County						
Revenues	2,500	2,500	2,500	2,500	2,500	2,500
Expenditures	2,500	2,600	2,600	2,600	2,600	2,600
School District 1						
Revenues	6,900	6,900	6,900	6,900	6,900	6,900
Expenditures	6,900	7,000	7,000	7,000	7,100	7,200
Buffalo						
Revenues	2,400	2,400	2,400	2,400	2,400	2,400
Expenditures	2,400	2,400	2,400	2,400	2,400	2,400
Natrona County						
Revenues	42,900	42,900	42,900	42,900	42,900	42,900
Expenditures	42,900	43,400	43,400	43,900	44,700	45,100
School District 1						
Revenues	37,200	37,200	37,200	37,200	37,200	37,200
Expenditures	37,200	37,600	37,600	38,000	38,700	39,100
Casper						
Revenues	50,400	50,400	50,400	50,400	50,400	50,400
Expenditures	50,400	51,100	51,100	51,700	52,600	53,100
Niobrara County						
Revenues	1,000	1,000	1,000	1,000	1,000	1,000
Expenditures	1,000	1,000	1,000	1,000	1,000	1,000
School District 1						
Revenues	3,100	3,100	3,100	3,100	3,100	3,100
Expenditures	3,100	3,100	3,100	3,100	3,100	3,200
Lusk						
Revenues	1,600	1,600	1,600	1,600	1,600	1,600
Expenditures	1,600	1,600	1,600	1,600	1,600	1,700

(continued on next page)

REVENUES AND EXPENDITURES--EASTERN AND WESTERN POWDER RIVER REGION (continued)

Platte County						
Revenues	2,200	2,200	2,200	2,200	2,200	2,200
Expenditures	2,200	2,300	2,300	2,300	2,300	2,400
School District 1						
Revenues	5,300	5,300	5,300	5,300	5,300	5,300
Expenditures	5,300	5,400	5,400	5,500	5,500	5,600
Wheatland						
Revenues	2,600	2,600	2,600	2,600	2,600	2,600
Expenditures	2,600	2,600	2,600	2,600	2,700	2,800
School District 2						
Revenues	1,000	1,000	1,000	1,000	1,000	1,000
Expenditures	1,000	1,100	1,100	1,100	1,100	1,100
Guernsey						
Revenues	500	500	500	500	500	500
Expenditures	500	500	500	500	500	500
Sheridan County						
Revenues	19,700	19,700	19,700	22,100	23,700	23,700
Expenditures	19,700	20,000	21,600	22,800	22,300	24,400
School District 2						
Revenues	13,300	13,300	13,300	17,400	20,300	20,300
Expenditures	13,300	13,400	14,500	15,300	15,000	16,400
Sheridan						
Revenues	9,600	9,600	9,600	9,900	10,000	10,000
Expenditures	9,600	9,700	10,500	11,000	10,800	11,800
Weston County						
Revenues	5,400	5,400	5,400	5,400	5,400	5,400
Expenditures	5,400	5,400	5,400	5,500	5,500	5,600
School District 1						
Revenues	5,200	5,200	5,200	5,200	5,200	5,200
Expenditures	5,200	5,200	5,200	5,300	5,300	5,400
Newcastle						
Revenues	2,300	2,300	2,300	2,300	2,300	2,300
Expenditures	2,300	2,400	2,400	2,400	2,400	2,400
School District 7						
Revenues	1,800	1,800	1,800	1,800	1,800	1,800
Expenditures	1,800	1,900	1,900	1,900	1,900	1,900
Upton						
Revenues	1,900	1,900	1,900	1,900	1,900	1,900
Expenditures	1,900	1,900	1,900	1,900	1,900	2,000

TABLE 4-19

POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE IN THE NORTHERN POWDER RIVER REGION

(in thousands of dollars, rounded to the nearest $100,000)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Big Horn County						
Revenues	8,600	8,600	8,600	8,600	10,200	10,200
Expenditures	8,600	8,600	9,100	9,200	9,500	9,900
Big Horn County Schools						
Revenues	13,900	13,900	13,900	13,900	17,100	17,100
Expenditures	13,900	13,900	14,800	14,900	15,300	16,000
Hardin						
Revenues	1,100	1,100	1,100	1,100	1,100	1,100
Expenditures	1,100	1,100	1,200	1,200	1,200	1,200
Powder River County						
Revenues	7,200	7,200	10,700	11,900	9,700	11,900
Expenditures	7,200	7,200	11,600	12,600	9,400	12,600
Powder River County Schools						
Revenues	3,700	3,700	10,900	13,400	8,900	13,400
Expenditures	3,700	3,700	6,000	6,600	4,900	6,600
Broadus						
Revenues	300	300	300	300	300	300
Expenditures	300	300	500	500	400	500
Rosebud County						
Revenues	9,400	9,400	9,400	9,400	9,400	10,200
Expenditures	9,400	9,400	10,500	10,900	10,500	11,600
Rosebud County Schools						
Revenues	8,700	8,700	8,700	8,700	8,700	10,300
Expenditures	8,700	8,700	9,700	10,100	9,700	10,700
Ashland						
Revenues	210	210	210	210	210	210
Expenditures	210	210	400	560	550	580
Colstrip						
Revenues	7,000	7,000	7,000	7,000	7,000	7,000
Expenditures	7,000	7,000	7,700	7,800	7,400	8,300
Forsyth						
Revenues	1,900	1,900	2,100	2,200	2,000	2,300
Expenditures	1,900	1,900	2,100	2,200	2,000	2,300

NOTE: Debt servicing is included. See text for derivation.

TABLE 4-20
POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

(in thousands of dollars, rounded to the nearest $100,000)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Crow Reservation						
Revenues (1990)[a]	8,900	8,900	8,900	8,900	8,900	8,900
Expenditures (1990)[b]	8,900	8,900	9,400	9,400	9,800	10,200
Lodge Grass						
Revenues (1990)[a]	120	120	120	120	120	120
Expenditures (1990)[b]	120	120	130	130	130	140
Northern Cheyenne Reservation						
Revenues (1990)[a]	10,100	10,100	10,100	10,100	10,100	10,100
Expenditures (1990)[b]	10,100	10,100	10,900	11,100	10,700	11,900

a. Under Alternative 1 or 2, it is assumed that revenues would equal expenditures through taxation, user fees, grants, or debt. Revenues are not expected to increase under the other alternatives, as the reservations are not expected to benefit from gross proceeds or property taxes.

b. Expenditures are projected on the basis of 1980 per capita expenditure levels.

COMMUNITY SERVICES

Tables 4-21 through 4-25 present estimates of community services or facilities that would be required under the alternatives in the Powder River Region. The estimates are based on the levels per thousand population that existed in 1979-1980.

When a service or facility did not exist in 1979-1980, a footnote indicates the method that was used for measuring the additional need for that service or facility.

It will be seen that the estimates for alternatives that do not propose additional federal competitive leasing are the same as the projections for 1990 in the affected environment, chapter 3.

SOCIOLOGY

Alternative 2

The most significant and visible social consequences of implementing Alternative 2 would occur in Sheridan and Campbell counties, Wyoming, in the late 1980s and early 1990s. However, the projected population increase over the baseline is such that the changes in community life would be routine and subtle even at peak.

Both of these counties, and the major communities within them, are in strong positions to absorb the projected growth effectively. Both areas have experienced industrialization previously and have relatively large and diversified populations. Services and facilities are broadly developed. The Wyoming regulatory environment is well established and local leaders and administrators have been exposed to growth management issues. In short, development of the tracts included in Alternative 2 should present unremarkable social effects.

The effects of leasing maintenance tracts in Montana also would be minor, because the consequences—additional employment and related community change—have largely occurred already in Forsyth, Colstrip, and Sheridan, Wyoming (which would be affected by development of Montana tracts).

Alternative 3

Wyoming

The absolute population effects of implementing Alternative 3 would be greater in Wyoming than in Montana. However, the projected baseline population levels in 1990 and 1995 (with no additional leasing) are much greater for Wyoming than for Montana. In a relative sense, the social consequences of this alternative would not be nearly as profound in Campbell and Sheridan counties, Wyoming, as those that would be expected in Montana. The effects that would occur in Wyoming can appropriately be described as moderate, because the capacity of Sheridan and Gillette and their respective counties to absorb population is much higher than that of the Montana communities (see the "Sociology" section of chapter 3).

It is likely that trends already long evident in these areas, such as segmentation, growth of the bureaucracy, and impersonalization, would be magnified. Personal behaviors that indicate instability—divorces, lack of commitment to community, dropouts—would be perpetuated somehwat by this additional future growth. However, both Campbell and Sheridan counties are expected to continue to have relatively high levels of in-migration, with attendant community and personal uncertainties, regardless of a particular federal action; therefore, the direct effects of Alternative 3 would be marginal and incremental.

Montana

Leasing and development of the tracts in Alternative 3 would have profound and durable social consequences in southeast Montana. The effects would be most evident during the late 1980s and early 1990s but would persist during the operational life of the development. Indeed, it is likely that eventual closure of the operations would be as difficult for future residents of several communities as would the construction period. For many communities that have been dependent on large industrial operations, the ultimate closing of those facilities has proved to be traumatic.

The social effects expected in Montana during the next decade under Alternative 3 would fall largely in Powder River and Rosebud counties. Consequences in Big Horn County would not be significant. Both absolutely and relatively, the central location of the effects would be in Powder River County, an area with a low baseline population and the largest projected population increases.

TABLE 4-21
PROJECTED 1990 SCHOOL ENROLLMENT AND HOSPITAL BEDS REQUIRED UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
SCHOOL ENROLLMNT						
Eastern and Western Powder River Region						
Gillette	8,600	9,100	9,100	9,400	9,400	10,300
Douglas	2,350	2,380	2,380	2,420	2,420	2,550
Glenrock	1,390	1,410	1,410	1,430	1,430	1,510
Sundance	520	530	530	530	530	540
Moorcroft	480	490	490	490	490	490
Torrington	2,020	2,040	2,040	2,070	2,090	2,140
Buffalo	1,680	1,700	1,700	1,700	1,720	1,750
Casper	15,800	16,000	16,000	16,200	16,500	16,700
Lusk	630	630	630	640	640	650
Guernsey	320	320	320	330	330	340
Wheatland	1,620	1,660	1,660	1,670	1,670	1,730
Sheridan	4,400	4,400	4,800	5,000	4,900	5,400
Newcastle	1,730	1,750	1,750	1,760	1,760	1,800
Upton	560	570	570	580	580	590
Northern Powder River Region						
Big Horn County	3,360	3,360	3,600	3,600	3,700	3,900
Powder River County	1,070	1,070	1,720	1,890	1,400	1,890
Rosebud County	3,700	3,700	4,200	4,400	4,200	4,600
Crow and Northern Cheyenne Indian Reservations						
Ashland (on reservation)	600	600	650	660	640	710
Busby	310	310	340	340	330	370
HOSPITAL BEDS						
Eastern and Western Powder River Region						
Gillette	58	62	62	64	64	69
Douglas	37	37	37	38	38	40
Sundance	18	18	18	18	18	18
Torrington	68	69	69	70	70	72
Buffalo	42	43	43	43	43	44
Casper	329	333	333	337	343	347
Lusk	13	13	13	13	13	14
Wheatland	33	34	34	34	35	35
Sheridan	126	127	138	145	143	156
Newcastle	58	60	60	60	60	61
Northern Powder River Region						
Big Horn County	70	70	75	75	78	81
Powder River County[a]	19	19	30	33	24	33
Rosebud County	38	38	43	44	43	47
Crow Reservation						
Crow Agency	47	47	50	50	51	54
Northern Cheyenne Indian Reservation[a]	21	21	23	23	22	25

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

[a] Figures are based on a regional average of 4 beds per 1,000 population.

TABLE 4-22
SWORN LAW OFFICERS REQUIRED IN 1990 UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Eastern and Western Powder River Region						
Campbell County	47	50	50	51	51	56
Gillette	58	62	62	64	64	69
Converse County	12	12	12	12	12	13
Douglas	12	12	12	12	12	13
Glenrock	10	10	10	10	10	10
Crook County	4	4	4	4	4	5
Sundance	5	6	6	6	6	6
Moorcroft	4	4	4	4	4	5
Goshen County	5	5	5	5	5	5
Torrington	16	16	16	16	16	17
Johnson County	10	10	10	10	10	10
Buffalo	8	9	9	9	9	9
Natrona County	73	74	74	75	77	77
Casper	136	138	138	140	142	144
Niobrara County	2	2	2	2	2	2
Lusk	7	7	7	7	7	7
Platte County	5	5	5	5	5	5
Guernsey	5	5	5	6	6	6
Wheatland	9	9	9	9	10	10
Sheridan County	9	9	10	11	10	11
Sheridan	38	38	41	43	43	47
Weston County	7	7	7	7	7	7
Newcastle	14	14	14	14	14	14
Upton	7	7	7	7	7	7
Northern Powder River Region						
Big Horn County	22	22	24	24	25	26
Hardin	a	a	a	a	a	a
Powder River County	7	7	12	13	10	13
Broadus	a	a	a	a	a	a
Rosebud County	28	28	31	32	31	35
Ashland	a	a	a	a	a	a
Colstrip	a	a	a	a	a	a
Forsyth	a	a	a	a	a	a
Crow Reservation	21	21	22	22	23	24
Crow Agency	16	16	17	17	18	19
Lodge Grass	3	3	3	3	3	3
Northern Cheyenne Reservation	22	23	23	24	23	25
Ashland (on reservation)[b]	1	1	1	1	1	1
Birney (on reservation)[b]	0	0	0	0	0	0
Busby[b]	2	2	2	2	2	2
Lame Deer[b]	4	4	4	4	4	5

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. It is assumed that the county can continue to provide adequate law enforcement services.

b. Projections are based on a regional average of 1.4 officers per 1,000 population.

TABLE 4-23
FIREFIGHTERS REQUIRED IN 1990 UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer
Eastern and Western Powder River Region												
Campbell County												
Gillette	9	41	10	44	10	44	10	45	10	45	11	49
Coverse County												
Douglas		35		36		36		36		36		38
Glenrock		30		30		30		30		31		32
Crook County												
Sundance		16		17		17		17		17		17
Moorcroft		31		31		31		31		31		32
Goshen County												
Torrington		49		49		49		50		50		51
Johnson County												
Buffalo		21		21		21		21		21		21
Natrona County												
Casper	111		112		112		114		116		117	
Niobrara County												
Lusk		26		26		26		26		27		27
Platte County												
Guernsey		26		27		27		27		27		28
Wheatland		54		55		55		55		57		58
Sheridan County												
Sheridan	23		24		26		27		27		29	
Weston County												
Newcastle		56		57		57		57		57		58
Upton		35		35		35		35		35		36
Northern Powder River Region												
Big Horn County		32		32		34		35		36		37
Hardin		28		28		30		30		31		32
Powder River County		28		28		45		49		36		49
Broadus		a		a		a		a		a		a
Rosebud County												
Ashland		4[b]		4[b]		7[b]		10[b]		10[b]		10[b]
Colstrip		40		40		43		44		41		46
Forsyth		23		23		25		26		24		27

Crow Reservation						
Crow Agency	14	14	15	15	15	16
Lodge Grass	14	14	15	15	15	16
Northern Cheyenne Reservation						
Ashland (on reservation)[b]	3	3	3	4	3	4
Birney (on reservation)[b]	1	1	1	1	1	1
Busby[b]	7	7	8	8	7	8
Lame Deer[b]	17	17	19	19	19	20

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. It is assumed that the county can continue to provide adequate firefighting services.

b. Projections are based on a regional community average of 6 volunteers per 1,000 population.

TABLE 4-24
WATER CAPACITY REQUIRED IN 1990 UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION
(in millions of gallons per day)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Eastern and Western Powder River Region						
Gillette	6.7	7.2	7.2	7.4	7.4	8.1
Douglas	4.1	4.2	4.2	4.2	4.2	4.5
Glenrock	1.8	1.8	1.8	1.8	1.9	1.9
Sundance	0.7	0.7	0.7	0.7	0.7	0.7
Moorcroft	0.3	0.3	0.3	0.3	0.3	0.3
Torrington	3.0	3.1	3.1	3.1	3.1	3.2
Buffalo	4.6	4.7	4.7	4.7	4.7	4.8
Casper	30.3	30.7	30.7	31.1	31.6	32.0
Lusk	2.4	2.4	2.4	2.4	2.4	2.5
Guernsey	1.0	1.0	1.0	1.0	1.0	1.1
Wheatland	3.6	3.7	3.7	3.7	3.8	3.9
Sheridan	13.0	13.1	14.3	15.0	14.7	16.0
Newcastle	4.9	5.0	5.0	5.0	5.0	5.1
Upton	1.0	1.0	1.0	1.0	1.0	1.0
Northern Powder River Region						
Hardin	5.6	5.6	5.9	5.9	6.2	6.4
Broadus	0.9	0.9	1.5	1.6	1.2	1.6
Ashland	a	a	a	a	a	a
Colstrip	b	b	b	b	b	b
Forsyth	5.1	5.1	5.5	5.6	5.3	5.9
Crow Reservation						
Crow Agency	1.2	1.2	1.3	1.3	1.4	1.4
Lodge Grass	0.4	0.4	0.4	0.4	0.4	0.4
Northern Cheyenne Reservation						
Ashland (on reservation)	0.1	0.1	0.1	0.1	0.1	0.1
Birney (on reservation)	0.1	0.1	0.1	0.1	0.1	0.1
Busby	0.2	0.2	0.2	0.2	0.2	0.2
Lame Deer	0.5	0.5	0.6	0.6	0.6	0.6

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. Ashland has water capacity to serve a population of 2,500. The largest population projected for Ashland is 1,700 under Alternative 6.

b. Colstrip has water capacity to serve a population of 7,200. The peak population projected for Colstrip under is 2,530 for Alternative 6.

TABLE 4-25
SEWAGE CAPACITY REQUIRED IN 1990 UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION
(in millions of gallons per day except where otherwise noted)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Eastern and Western Powder River Region						
Gillette	3.2	3.4	3.4	3.5	3.5	3.8
Douglas	0.4	0.4	0.4	0.4	0.4	0.4
Glenrock	1.8	1.8	1.8	1.8	1.9	1.9
Sundance	0.3	0.3	0.3	0.3	0.3	0.3
Moorcroft	0.2	0.2	0.2	0.2	0.2	0.2
Torrington	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.1[a]	1.2[a]
Buffalo	0.7	0.7	0.7	0.7	0.7	0.8
Casper	7.6	7.7	7.7	7.8	7.9	8.0
Lusk	0.3	0.3	0.3	0.3	0.3	0.3
Guernsey	0.5	0.5	0.5	0.5	0.5	0.5
Wheatland	1.3	1.3	1.3	1.3	1.4	1.4
Sheridan	6.5	6.6	7.1	7.5	7.4	8.0
Newcastle	2.8	2.8	2.8	2.8	2.8	2.9
Upton	0.6	0.6	0.6	0.6	0.6	0.6
Northern Powder River Region						
Hardin	b	b	b	b	b	b
Broadus	4.8[c]	4.8[c]	7.7[c]	8.3[c]	6.3[c]	8.4[c]
Ashland	d	d	d	d	d	d
Colstrip	e	e	e	e	e	e
Forsyth	0.7	0.7	0.8	0.8	0.8	0.8
Crow Reservation						
Crow Agency	23.0[c]	23.0[c]	25.0[c]	25.0[c]	26.0[c]	27.0[c]
Lodge Grass	16.0[c]	16.0[c]	17.0[c]	18.0[c]	18.0[c]	19.0[c]
Northern Cheyenne Reservation						
Ashland (on reservation)	6.0[c]	6.0[c]	6.0[c]	6.0[c]	6.0[c]	7.0[c]
Birney (on reservation)	3.0[c]	3.0[c]	3.0[c]	3.0[c]	3.0[c]	3.0[c]
Busby	4.0[c]	4.0[c]	5.0[c]	5.0[c]	5.0[c]	5.0[c]
Lame Deer	14.0[c]	14.0[c]	16.0[c]	16.0[c]	16.0[c]	17.0[c]

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. Based on a standard of 168 gallons per capita per day.

b. Hardin has sewage treatment capacity to serve a population of 6,000. The heaviest population projected for Hardin is 5,300 under Alternative 6.

c. Surface acres of sewage lagoon.

d. Ashland has sewage capacity to serve a population of 2,500. The heaviest population projected for Ashland under this analysis is 1,700 for Alternative 6.

e. Colstrip has sewage capacity to serve a population of 7,500. The heaviest population projected for Colstrip is 2,530 under Alternative 6.

Powder River County

Powder River county is vulnerable to the effects described above. As the "Sociology" section of chapter 3 explains, this rural-agricultural area has had little exposure to industrialization and possesses a limited base of services and facilities. There is no planning mechanism, and city and county leaders have only limited or no experience in responding to growth management questions. Coordination with state government agencies responsible for providing rapid-growth assistance is untested. For these reasons, Powder River County, Broadus, and the rural areas of the county would undergo a radical transformation.

The short-term construction period would be characterized by chaotic conditions in housing, law enforcement, education, and similar areas of community life. The county's population would be increasingly transient and industrial, in sharp contrast to the existing pattern of overall stability and predictability. The adaptability of longtime residents would be stressed, at least during the short term. Uncertainty and anxiousness would be widespread among residents, particularly the elderly.

Through time, perhaps by the early or mid-1990s, conditions would become stabilized, but the long-term changes in the county would be substantial in the centers of population. Virtually every aspect of community life—education, religion, interpersonal relations, recreation, and so on—would be affected.

Rosebud County

For several reasons, the community in Rosebud County that would be most affected by Alternative 3 is Ashland. Like Broadus and Powder River County, Ashland has a limited capacity to respond to change effectively. The conditions are similar, with the additional complications that Ashland is unincorporated and culturally fragmented. The community simply has few resources to draw upon for dealing with rapid growth, both now and in the foreseeable future. Conditions to be expected in the short term and the post-construction period parallel those described above for Powder River County and its communities.

The social effects of this alternative would be moderate elsewhere in Rosebud County, except possibly on the Northern Cheyenne Indian Reservation, which is discussed in the next section. The expected base conditions in Forsyth and Colstrip are such that the levels of growth under this alternative could be managed without extensive or intensive difficulty. In fact, such development probably would supplement similar changes that already have occurred because of past development, and it probably would be widely viewed as beneficial.

The Northern Cheyenne Indian Reservation

It is projected that some non-Indian persons and families would locate in or near Lame Deer, Busby, Birney, and other reservation communities. Furthermore, development near the reservation could draw non-reservation Northern Cheyenne to live on the reservation. For Alternative 3, it is projected that population levels in 1990 would be roughly 8% above the baseline.

There are severe public administrative problems on the reservation, and social problems among individuals are widespread and chronic. Given these conditions and potential cultural incompatibility, even a few hundred additional non-Indians and Indians on the homeland would further intensify uncertainties and resentment on such issues as law enforcement authority, economic prosperity, and access to public services and facilities. The potential for cultural deterioration would be increased if non-Indian influences became further established and prevalent. The reservation is vulnerable to growth even on a moderate scale.

Increased traffic on U. S. Highway 212, Montana 39, and County 314, along with persistent jurisdictional problems, would present problems for reservation residents. Trespass, poaching, unsafe driving conditions and behaviors, and unauthorized use of tribal facilities probably would increase. Tribal law enforcement personnel would have to deal with higher levels of misconduct, and the tribal police do not have jurisdiction over non-Indians. Medical emergencies on the reservation would be likely to increase somewhat, and the tribal ambulance service responds to all calls on the reservation (Northern Cheyenne Tribe 1983a). Therefore, this capacity might be exceeded, along with firefighting capability.

At the same time, it should be recognized that additional federal leasing under this and other alternatives would have potential benefit for the Northern Cheyenne. Off-reservation employment opportunities, as at Colstrip, could result in dependable jobs for a significant number of persons. This would help the Northern Cheyenne maintain their cultural distinction by allowing them to live on the reservation while securing their economic livelihood elsewhere. However, without an employment agreement, the likelihood of this happening is very limited.

There are currently few other economic development alternatives in sight. Non-Indian migration to the reservation might attract retail and other capital investments. The tribe is actively seeking such commercial sitings. Perhaps leverage would be increased toward improving schools, law enforcement, health care, and similar programs. Under Montana law, the tribe is now a potential recipient of grants and loans from the Montana Coal Board. Thus, the effects on the Northern Cheyenne would not be entirely negative, but tribe members would not be likely to benefit from surrounding development without special action.

Alternative 4

Wyoming

Development of the tracts included in Alternative 4 would generate consequential population increases in Wyoming.

Sheridan County

Effects of Alternative 4 on Sheridan and Sheridan County from both Wyoming and Montana mining operations would be particularly evident because tax revenues from Montana would not be shared with a county and community that would bear much of the impact of Montana development. Sheridan has a high capacity to absorb growth and change, but the addition of 5,000 to 6,000 persons above baseline during the next decade would present growth management issues for the county and the city.

The area has become increasingly urban and occupationaly industrial in the past decade. The level of growth above baseline projections due to Alternative 4 would move the area even more decidedly toward a social environment inconsistent with widespread notions that Sheridan remains an enclave of the Old West. National retail chains and franchises, labor unions, and a fairly high number of technical specialists are in evidence now and will remain. Interpersonal relations would be even more segmented and transient if this alternative should be implemented than without additional federal leasing. There would be intense pressure on officials—and the rest of the county's citizens—to deal with rapid growth. Thus, the capability of Sheridan and the county to respond effectively to these near-term stresses would be tested.

Campbell County

The effects of Alternative 4 on Gillette and Campbell County would be similar to those on Sheridan and Sheridan County, except that the city and county governments are better able to capture the revenues generated by additional coal operations. Social effects and tax revenues would coincide in Campbell County, which also has powerful siting legislation.

Broad-based acceptance of rapid growth is more likely in Campbell County than in Sheridan County. Campbell County's leaders and officials have more experience than their Sheridan counterparts, as was discussed in chapter 3. For these reasons, development under this alternative would not cause as much difficulty in Gillette as in Sheridan or in counterpart Montana areas.

Expansion, even extensive expansion, of the industrial base of Campbell County is socially compatable with both the present community structure and the social environment of the foreseeable future.

Montana

In general, the social effects in Montana from Alternative 4 would be similar to those of Alternative 3. However, there would be minor difference in magnitude and location.

Big Horn County

Again, the consequences in Big Horn County relative to the baseline generally would be moderate. Population increases, which cause social effects, are projected to be about 7% above baseline by 1990 for Big Horn County under Alternative 4. Hardin, with intermediate capacity to absorb change, would be noticeably affected, but not to the point of disruptiveness.

Powder River County

Powder River County, both in Broadus and in the rural areas, would bear the brunt of the effects of development of the tracts under Alternative 4. The Broadus population by 1990 would be roughly double that which would otherwise be expected. The likelihood of new subdivisions in the western part of the county would be high. For the entire county, but particularly for the few persons living in western Powder River County, these changes would be real, immediate, and intense.

The effects described for Alternative 3 would also occur under this alternative, but the magnitude and intensities would be marginally greater. Given the capacity of this area for social change, it is clear that development under this alternative would lead to wholesale and, at least for the next several decades, durable changes for Powder River County. As the economy moved from predominantly agricultural activities toward industrialization, the social environment would shift toward more diversity, uncertainty, transience, impersonalization, and segmentation.

Rosebud County

The central location of change in Rosebud County would be Ashland, where the population would be more than double the baseline level. While the Ashland area is expected to grow considerably by 1990 regardless of federal action, this alternative would push the community's population to a level three or four times higher than that of 1980. Ashland simply is not prepared for this level of growth. It remains small, unincorporated, and socially fragmented.

Widespread and intense disruptions for the community for newcomers and long-term residents could be expected. In addition, cultural conflicts between Northern Cheyenne and non-Indians would be heightened because the presence of so many newcomers adjacent to the reservation would lead to a variety of misunderstandings and resentments. Ashland would become a most difficult living environment, particularly between 1985 and 1995. Stability eventually would be established, but not without much stress.

The Forsyth and Colstrip areas would be moderately affected by development under Alternative 4. Their capacities to absorb change are intermediate, as are the projected growth levels. It is unlikely that development under this alternative would present more than routine management and absorption issues in the rest of the county.

The Northern Cheyenne Indian Reservation

It is projected that some non-Indians would move to the reservation and that there would be some return migration of non-reservation Northern Cheyenne, with the same type of effects as were described for Alternative 3. Assuming the reservation would have several hundred additional residents, growth management problems could be expected, particularly along the main transportation corridors. The number of persons projected above the baseline is not high, but the area's capacity to deal with growth is very limited. Problems would be evident in housing, law enforcement, emergency medical care, education, and racial friction.

The Crow Indian Reservation

A moderate level of in-migration of both Indians and non-Indians could be expected on the Crow Reservation under Alternative 4, but the ongoing presence of substantial numbers of non-Indians would serve to reduce what otherwise might be more substantial consequences. The present non-Indian land ownership and population on the reservation means that the Crow, more than the Northern Cheyenne, are familiar with having non-Indians in their routine pattern of life. Traffic loads, minor retail investments, conflicts between landowners and recreational users, and pressure on housing and public service and facilities would be evident. However, except in certain situations these effects would not be intense.

Alternative 5

Wyoming

Given the similarities between the forecast population effects of Alternative 5 in Wyoming and those projected under Alternative 4, current social assessment methods offer no processes to differentiate between the alternatives. The only difference is that Sheridan would be in a somewhat stronger position to capture benefits associated with Alternative 5, because a lower proportion of the production and population effects from Alternative 5 would originate in Montana. The siting process and attendant taxation procedure would help Sheridan and Sheridan County to deal with the changes. Otherwise, the effects in Wyoming would be virtually the same as those described for Alternative 4.

Montana

Local social effects in Montana from Alternative 5 would be considerably less severe than those from Alternative 4. This is due to the exclusion of the Mud Springs tract, on which interest in a power plant has been expressed. The absence of the high labor levels associated with construction of the plant reduces the overall multi-county consequences. Still, the expected effects of this alternative, shifting toward a more balanced pattern across the three-county area, are substantial, and in several cases problematic.

The increases in poulation in Broadus and the rest of Powder River County would be much lower than those projected for Alternatives 3 and 4. The effects in Powder River County would be similar to, but less intense than, those described for Alternative 3. All of Powder River County has limited capacity to absorb rapid change, both now and into the foreseeable future.

Ashland and the Northern Cheyennne Reservation are the only Rosebud County areas that would be significantly affected by this alternative. The effects in Ashland would be equivalent to those described for Alternative 4. The Northern Cheyenne Reservation and the tribe would experience changes similar to those described for Alternatives 3 and 4, but somewhat less intense.

Consequences in Big Horn County would be considerable in both the cities and the rural areas. The Hardin area should be able to respond effectively to the projected level of growth, since the levels are moderate and the city and immediate area have resources to employ in response. There would be effects on the Crow and the Crow Reservation parallel to those described for the Northern Cheyenne under Alternatives 3 and 4, but again the ongoing presence of many non-Indians on the Crow reservation would serve to reduce the relative consequences.

In summary, the Montana areas most heavily affected under this alternative would be Ashland and, to a lesser extent, Powder River County. The social effects elsewhere would be moderate but still significant. Community instability and personal disruptive behavior should be expected to be in evidence, along with issues such as public safety, housing, and education. These issues, which would require the ongoing attention of officials, would perhaps be most problematic on the two Indian reservations, where capacity to respond is limited.

Alternative 6

Wyoming

The Wyoming areas that would be significantly affected by Alternative 6 are Sheridan and Campbell counties. Both areas are protected by Wyoming's siting law, have firm relations with the state government, have experience with industry, and have relatively large, diversified, and occupationally industrialized labor forces. The capacities of these two counties to deal with local social changes are the highest in the Powder River Region, and both areas are expected to experience substantial population growth whether or not there is additional federal coal leasing.

Even so, population increases in the range of 20% over the baseline by 1990 are formidable. More intensified growth for a longer period would ensure that both Sheridan and Campbell counties would continue to be largely transient (as in schools) and socially unsettled. In such a community, newcomers could be expected to experience personal difficulties such as a lack of identification with place, a sense of isolation, much disruptive behavior, and poor housing. Longer-term residents, perhaps looking forward to stability, would have to face a new wave of latecomers.

It is likely that for many individuals this development would represent a persistence of past adaptive difficulties, while for the counties and communities, as different entities, the growth might be manageable except occasionally. The units of government probably are better prepared to deal with the level of growth, both short term and midterm, than are the residents within their jurisdictions.

Eventually, perhaps in the mid-1990s, stability would prevail, closely associated with a consistent demand for the coal resource. However, if production should drop during the life of the mines, an entirely different set of problems would appear. Public financial resources probably would diminish, and officials would face severe distributional questions as the demand for public assistance increased. Both Sheridan and Campbell counties would be further dependent on the operations of the mines and this economic activity for the economic lives of the counties and communities and their residents.

As under all alternatives, there would be severe dislocation problems at the time the facilities closed. Without plant closure legislation or enhanced diversification of the economic base, these events are virtually unavoidable. There would be severe effects at that time on retail, public finance, public facilities, real estate, and other components of community and individual life.

Montana

Alternative 6 would have profound, inventive, and durable local social effects in Montana during the next decade, during operation of the mines, and upon closure of the facilities. Regional economic development would be enhanced, but the local social effects, compared to the present and to the future without additional federal leasing, would be extremely adverse if the goal is to maintain future options that approximate those of the present and the recent past.

Elsewhere, the population changes would be even greater than those for other alternatives, jeopardizing the stability that otherwise would be expected to prevail under the baseline or the lower production alternatives. Big Horn County and the Crow Reservation, in particular, would face an increase of roughly 15% more than the baseline by 1990.

Powder River County

Much of the social assessment for other alternatives applies to this one as well; for example, the elaborate and widespread effects described for Powder River County under Alternative 4 would be virtually the same under Alternative 6.

Rosebud County

Effects in Rosebud County would be widespread. Ashland would undergo a transformation equivalent to that described for Alternatives 4 and 5. This level of growth would simply alter the physical and social environment until it was unrecognizable. Long-term residents would have to cope with many transient newcomers, uncertainty, information of unknown reliability, and a more urbane atmosphere. It probably would be intolerable to some. For example, Northern Cheyenne on the east side of the Tongue River might move to the reservation because of feelings of minority status and alienation resulting from increasing numbers of non-Indians.

The Colstrip and Forsyth areas would be affected, but growth there probably would be accommodated without wholesale change or disruption. These communities haver higher capacities to absorb change than Ashland does. The effects during both the pre-operation and operation stages would be manageable and probably would be seen as generally beneficial.

The Northern Cheyenne Indian Reservation

Alternative 6 would cause substantial changes on the Northern Cheyenne Reservation. Effects described for Alternatives 3, 4, and 5 would be evident, but even more intense and widespread. The addition of several hundred non-Indians to the reservation would further stress racial-cultural relations and the tribal government's ability to operate effectively. It also could put further pressure on the limited base of services and facilities. Areas along transportation corridors would be immediately and decidedly affected as traffic increased and residential and retail settlement took place. The Northern Cheyennes' sense of propriety toward the homeland would be reduced.

Perhaps of greatest importance is the likelihood that Northern Cheyenne who would not be able to take advantage of potential benefits would feel further deprived of economic comparability, as discussed under Alternative 3. This deprivation might be relative, but it would be very real to the persons who experienced it. It could further mire individuals in a cycle of poverty, lack of motivation and skills, and dependent behaviors that are widespread on the reservation. The presence of additional persons and families and the visibility of regional in-migrants to Colstrip, Ashland, Sheridan, and other communities would cause such feelings of deprivation.

The Crow Indian Reservation

While Hardin and its immediate environs have moderate capacities, the Crow and their reservation are vulnerable. Implementation of this alternative would result in even larger numbers of non-Indians on the Crow Reservation. This could present difficulty in cultural maintenance and cause heightened uncertainties on jurisdictional issues such as law enforcement and health care.

Tribal, Big Horn County, and Hardin officials would be under considerable pressure to manage the growth. Transience, impersonalization, and additional fragmentation would be apparent. Both absolutely and relatively, divorce and other family instabilities probably would increase.

Some increase in employment opportunity would be possible for the Crow. Some capital investment might be drawn to the reservation, and some improvement might occur in public facilities and services as a result of the development. However, distribution of these benefits would be uneven, perhaps resulting in many Crow experiencing increased frustrations beyond those now in evidence or those that would be expected without such change.

Additional gaps in wealth and access to public resources would be very likely to increase the sense of poverty and absence of a future among the Crow who would not benefit directly from the development. At best, only a relatively small segment of Crow would be direct and indirect recipients of jobs.

CHAPTER 5: PROPOSED MITIGATION OF SOCIAL, ENVIRONMENTAL, AND ECONOMIC ISSUES

INTRODUCTION

Social, environmental, and economic effects at the local level are important issues associated with the leasing of coal. In the Powder River Region, the Northern Cheyenne Tribe has expressed concern regarding social, environmental, and economic effects on the Northern Cheyenne Indian Reservation. The Northern Plains Resource Council has expressed concern about effects on local units of government.

Two specific elements are involved in dealing with social and economic effects: (1) Description of the expected effects by alternative and (2) portrayal of mechanisms that are available to respond to the projected community changes. The effects are assessed in chapter 4. As a means of sharing information with affected units of government, the assessments are of themselves important elements of the mitigation process. However, the focus of this chapter is the description of post-assessment processes of mitigating off-site social, environmental, and economic effects. In particular, mitigative measures proposed by the Northern Cheyenne Tribe and by the Northern Plains Resource Council will be considered.

For the proposed 1984 Powder River coal lease sale, mitigation proposals are primarily related to the potential leasing of Montana tracts. The reasons for this segmentation are explained in the following discussion. The discussion applies to all the leasing alternatives. Distinctions have not been made between maintenance tracts and new development tracts, even though the implications of the discussion differ considerably between the two types of tracts. The Northern Cheyenne Tribe believes there is no distinction between the two types of tracts.

Regulatory Environments in Montana and Wyoming

Montana and Wyoming have fundamentally different approaches in responding to rapid growth brought on by mineral development. Some sources of funding are similar—both states receive 50% of the bids and subsequent royalties generated by federal leasing and production; both states have severance taxes on coal production; and counties and communities in both states receive property tax revenues from industrial operations. However, Wyoming's passage of the 1975 Industrial Development Information and Siting Act gave local units of government considerable leverage in the permitting of mines, power plants, synfuels plants, and other large industrial developments.

This legislation is widely viewed as an effective means of responding to growth. It specifies that, as part of the permit application process, project proponents must describe their intentions for direct assistance to host communities that must absorb the off-site populations of the operations. Permits can be denied if these arrangements are judged not to be appropriate.

The situation in Montana is different. Severance tax monies are received by the state government, and a portion of the annual total is reserved for distribution to affected units of government through the Montana Coal Board. Attachment of off-site social and economic requirements is not provided for either by the Montana Environmental Policy Act or by the Montana Strip and Underground Mining and Reclamation Act, which guides mine plan permitting in the state. The Major Facility Siting Act does present an opportunity for such requirements to be employed in the permitting of conversion facilities; however, mines are not included.

Because of Wyoming's siting legislation, Wyoming units of government possess a direct source of mitigation of the effects of proposed large or moderate sized mines that Montana communities do not have through state legislation and permitting requirements. Therefore, Montana communities are somewhat more vulnerable to rapid growth than are Wyoming communities. The timely acquisition by counties, school boards, other boards, and municipalities of funds to manage growth is less predictable in Montana than in Wyoming. There is ongoing dialogue in both states with regard to distributing royalty and severance tax funds equitably in terms of the location of the effects.

Local Siting Authority in Montana

Nothing prohibits local units of government in Montana from adopting measures that would give them authority to approve, deny, or qualify industrial operations being located in, for example, a particular county. These powers have not been exercised in the coal counties of southeastern Montana, however.

It appears that the Northern Cheyenne and Crow tribes possess adequate authority to prohibit both industrial operations and secondary consequences of those operations—mobile home parks, residential subdivisions, and the like—on-reservation.

The tribes clearly have the authority to control surface use of tribal lands. A 1982 Tenth Circuit Court of Appeals decision in Wyoming, *Knight, et al. v. Shoshone and Arapahoe Indian Tribes,* indicates the tribal authority in controlling surface use on privately owned land within the reservations is extensive, although not unlimited, independent of ownerhip (Indian or non-Indian), proponent's background (tribal members, Indians, non-Indians), and type of development. The tribes also have authority to control surface use of allotted land within the reservation, although the extent of this authority has not been judicially established. For both county and municipal governments and tribal governments in Montana, however, the feasibility of implementing these controls is evidently limited by the residents' historical mistrust of such measures. The Northern Cheyenne Tribe has concluded that such measures are not practical and not consistent with tribal policy.

The need for such measures in Wyoming is lessened by the presence of the Siting Act.

Montana Energy Impact Funding and Indian Tribes

On October 1, 1983, federally recognized Indian tribes in Montana became eligible for energy impact grants and loans from the Montana Coal Board. Since that date tribes have been able to apply for grants or loans as county, municipal, and other public entities have been able to do in the past.

Perhaps as important as the legal change described above in the context of this discussion is an implicit recognition on the part of the Montana state government that Indian tribal governments are jurisdictionally equivalent to other area units of government with regard to growth management funding. A source of assistance previously not accessible to the tribes is now available, even though it appears that limitations on this funding from the Montana Coal Board are pronounced and that documentation of past, present, future adverse consequences would be required. The tribes have no experience in applying for those grants and loans.

The Mineral Leasing Act and Off-site Mitigation

Two matters deserve attention with regard to the Mineral Leasing Act of 1920, as amended in 1976. First, review of the legislative history of the act and its amendments revealed that congressional intent in responding to off-site social and economic funding problems arising from mineral leasing is limited to the sharing of federal revenues from bonus bids, rent, and royalty. Despite full opportunity to provide the Secretary of the Interior with additonal powers (at least in considering the 1976 amendment), the Congress approved no other fiscal mechanisms. This limits the secretary's ability to require the lessee to provide funding, and it is consistent with traditional separation of responsibilities between the federal and state governments.

Second, section 30 of the act authorizes inclusion of terms and conditions in mineral leases for protection of the public welfare. This statement empowers the Secretary of the Interior with broad discretionary authority in terms of federal mineral leasing. However, these broad powers historically have not been exercised with regard to off-site social and economic effects.

Thus, one interpretation of the Mineral Leasing Act relative to this issue is that the Secretary of the Interior may choose to condition leases to protect the general welfare but that Congress has specifically addressed the sharing of funds with host states. Additional funding mechanisms may be viewed as contrary to the intent of Congress. However, this would not necessarily preclude other, nonfiscal measures that the secretary might choose to implement to safeguard the welfare of citizens or communities affected by leasing.

Section 35 of the Mineral Leasing Act establishes the national policy that state legislatures address fiscal response at the sub-state level to conditions caused by leasing. That section expressly authorized the use of redistributed lease revenues by the legislatures to mitigate impacts in affected localities. However, section 35 does not address parallel matters on Indian reservations in the vicinity of off-reservation federal leasing.

Federal Mine Plan Review and Off-site Mitigation

There is substantial legal dispute as to whether SMCRA or NEPA provides sufficient authority for the Secretary of the Interior to attach to mine plan permits any stipulations or requirements regarding off-site social and economic conditions. If the Department of the Interior chooses to address these matters in its coal management process, it is advisable that it do so at the leasing stage to avoid the risk of being unable to do so when reviewing permit application packages.

The decision above is a preliminary analysis. A more detailed review is needed to consider the policy and legal questions concerning the proposals submitted.

PROPOSALS RECEIVED

Background

The Powder River Regional Coal Team unanimously approved a motion at its June 21, 1983, meeting that invited the Northern Cheyenne tribe to submit its proposed mitigating measures. A commitment was made to consider those proposed measures in the draft EIS. The tribe's proposed measures, which are in the form of potential lease stipulations, are summarized and discussed in this chapter. The complete text of the tribe's proposal appears in appendix F. The proposed stipulations apply in concept to all Montana tracts, both maintenance and new production.

The Northern Plains Resource Council (NPRC) submitted a proposal for mitigation of social and economic effects on local units of government.

No mitigation proposals were invited or received from entities in Wyoming. This is perhaps indicative of the solid position of the potentially affected communities and counties in their ability to respond to rapid growth.

Northern Cheyenne Proposals

The proposals of the Northern Cheyenne are summarized and discussed in the following sections. It should be made clear that the steps discussed below are proposals. Other mechanisms designed to achieve the same or similar goals are open for discussion; however, the discussion in this section is confined to the proposals of the Northern Cheyenne Tribe. In each case, implementation would be through written agreements to be pursued immediately after the successful bidder was identified.

Review of each of these measures should include consideration of the Secretary of the Interior's well-established historical and continuing trust responsibilities relative to the Northern Cheyenne and other Indian tribes. Among these responsibilities are protection of the homeland, coordination of the provision of services and facilities, and the implementation of measures that enhance living conditions and economic opportunity.

The BLM, through its coal leasing and other resource programs, has not in the past been a major factor in implementing the trust responsibilities of the Secretary of the Interior. However, it is clear that both coal leasing and trust responsibilities relative to Indian tribes rest with the Department of the Interior.

Proposed Measure 1: Employment Preference

Proposal

The Northern Cheyenne Tribe proposes that tribe members and members of tribal families be given preferential consideration in recruitment, training, hiring, promotion, and workforce reductions in all categories of employment attached to development of the tracts. This requirement, according to the proposal, would be implemented through a written agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior. The agreement would cover the following programs:

Quantitive goals and schedules for each employment category

Protection of the lessee with regard to personnel decisions

Recruitment of preferred employees

Training

Scholarships and tuition programs

Cultural awareness workshops for non-Indians

Mass transportation programs for commuting workers

Announcement of the preferential program to involved labor unions

Requirements for contractors and subcontractors to abide by the agreement on employment preference

Establishment of a lessee-tribal employment committee

The lessee's bearing of administrative costs associated with the employment committee

Discussion

Attaching the proposed stipulation would have broad effects that are not quantifiable at this time. Specifics of the proposed agreements are unknown. For the Northern Cheyenne, it obviously would result in an improved climate of economic opportunity. Unemployment has been and remains high among the Northern Cheyenne, and a number of associated social problems may be related to a sense of lack of job potentials either in the near term or in the long term. Perhaps some off-reservation Northern Cheyenne would be attracted back to the reservation for residential purposes.

For the tribe itself, the proposed stipulation would serve to reduce the dependence of some tribal members on scarce tribal funding resources.

It is likely that the requirements of the proposed stipulation would reduce the projected level of non-Indian in-migration onto the reservation that could result from additional federal coal leasing. To some extent the lower level of in-migration would address the expected land use changes (trailer parks, residential subdivisions), stress on transportation corridors, and potential cultural conflict situations that would be attached to moderate levels of population change.

Effects associated with population growth in off-reservation areas and communities also would be moderated because the projected level of labor in-migration to those areas would be reduced.

Major uncertainties also deserve attention. It is not known how the application of the proposed stipulation would affect the private sector's view of the value of the coal resource. As it would serve to increase production costs either substantially or marginally, the effect could be to reduce the market value of the resource. The tribe has concluded that this factor should not affect consideration of the measure in any way.

Furthermore, labor supply could be in question—it would depend on the level of surplus labor (which appears to be adequate), the level of sequencing of production, the actual agreed-upon levels of preferential hiring and training, and similar factors. It is not known if available labor exists to fulfill the requirements, but it is assumed that it would be available. As a practical matter, the application of the proposed stipulation on maintenance tracts might be quite difficult. However, the tribe has suggested that this measure could be implemented as turnover in existing jobs took place.

Authority for employment preferences may rest in section 30 of the Mineral Leasing Act. In addition, section 703(i) of the 1964 Civil Rights Act legitimizes preferential treatment of Indians in employment practices for enterprises on or near Indian reservations. Non-Indian family members may not be covered by that legislation, however—the act refers only to Indians.

The major alternative to making this proposal a stipulation is an approach that would not directly involve the federal government. The Crow Tribe has a preferential employment agreement with Westmoreland Resources at the Absaloka mine, and it appears to be effective. The Northern Cheyenne and the Montana Power Company signed a preferential employment agreement of the type discussed here in 1980. Its effect has been viewed positively by the tribe. In that case, however, because the power company was operating a coal-fired power plant, the tribe was able to use its Class I air quality status as a means of reaching an agreement. Such a point of leverage might not be available to the tribe in connection with Powder River Region leasing for mines from which the coal would be transported out of the region.

Encouragement of such approaches by the Department of the Interior and the state probably would be the main alternative to a requirement like that proposed by the Northern Cheyenne. The Northern Cheyenne do not believe that such voluntary approaches would be effective, because employment of tribe members at other mining sites in the region is very limited.

Proposed Measure 2: Contracting Preference

Proposal

The Northern Cheyenne Tribe proposes that businesses controlled by the Northern Cheyenne Tribe or its members be given preferential consideration in all contract awards associated with conduct of operations and purchases of material and equipment for operations. According to the proposal, this requirement would be implemented through an agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior. This agreement would cover the following points:

Quantitive goals and schedules for their achievement

A certification procedure under which a business seeking preferred status would document (a) its control by the tribe or a tribal member and (b) its capability of providing particular services, materiel, or equipment

Technical and financial assistance to prefered businesses in obtaining certification

Advance notice to preferred businesses of contracts to be awarded

In competitive situations, the establishment of formulas for the granting of competitive margins (a reasonable sum by which a preferred business's bid could exceed all other bids)

A requirement of all contractors and subcontractors that they in turn also comply with terms of the agreement

Establishment of a contracting preference committee with members from the lessee and the tribe

The lessee's bearing of administrative costs associated with the contracting preference committee

Discussion

The proposed stipulation would have effects similar to those discussed for the employment preference proposal. Employment would be generated by the economic activity on the reservation resulting from the proposal, and capital investments on the reservation would be enhanced. If Indian businesses were consistent in hiring Indians, the level of non-Indian in-migration would be somewhat reduced. If the Indian businesses hired non-Indians, it could actually increase the number of non-Indians on the reservation.

As would be true of the employment preference proposal, implementing this proposed stipulation could affect the level of private sector interest and the bid value of the potential leases covered by this stipulation. The level of that effect is not known. Furthermore, the application of the proposed requirement on maintenance tracts would be difficult, because maintenance tracts would be added to ongoing operations with existing contracts. The Northern Cheyenne Tribe has concluded that market value factors do not constitute a valid criterion of consideration. The tribe suggests that the measure could be implemented on existing operations as contracts expire.

At this time, the number and types of Northern Cheyenne-controlled businesses that could take advantage of this opportunity are very limited. The idea of the proposal is that such agreements would lead to the creation of appropriate businesses with sufficient backing to acquire needed loans for investment. Again, the tribe's goal is to capture more benefits of nearby coal development than has occurred in the past.

Authority for stipulating contracting preference may rest in section 30 of the Mineral Leasing Act.

An alternative method of achieving the goals of this proposed stipulation would be the establishment of voluntary programs between the lessee and the tribe. Federal involvement would be absent from such a program, and its effectiveness is uncertain. The tribe has concluded that such an approach would be ineffective and impractical.

Proposed Measure 3: Law and Order and Traffic

Proposal

The Northern Cheyenne Tribe proposes that each lessee be required to obtain a covenant from each of its employees that the employee, while on the reservation, will comply with all standards of conduct generally applicable to tribe members. Truckers operating on the reservation also would be required to sign a covenant with the lessee to operate their vehicles in compliance with all laws, ordinances, and rules applicable to the use of motor vehicles by tribe members. Each lessee would contractually require each of its contractors, subcontractors, and suppliers to obtain like covenants from their truckers and employees. Enforcement, through disciplinary action, would be the responsibility of the lessee, contractors, and subcontractors if a violation was reported by the tribe.

These provisions would be implemented by an agreement between the tribe and the lessee, subject to approval by the Secretary of the Interior. The agreement would cover the following points:

As a condition of employment, written assumption of the conditions described above by each employee and each trucker

Education of employees and truckers on standards of conduct prevailing on the reservation

Appropriate employment-related disciplinary procedures for particular violations

Resolution of disputes concerning the occurrence of violations

Notification to labor unions of the agreement

Funding by the lessee to cover administrative costs incurred by the tribe in implementing the agreement

Discussion

Implementation of the proposed measure could reduce the expected adverse public safety consequences on and along transportation corridors on the reservation. These anticipated consequences are described in chapter 4. Truck traffic on highway 212 is dangerous, and increased volume would worsen the problem. Delays in processing offenders occur because of jurisdictional complications on the reservation, particularly off the state highways.

The costs to the lessee associated with this proposed stipulation probably would be minor, but the introduction of an administrative process could in itself be significant on occasion. Authority for making the proposed stipulation may be found in section 30 of the Mineral Leasing Act.

The major questions relative to this proposal involve the appropriate federal role. First, law enforcement in regard to vehicular traffic and other nonfelony offenses generally is the responsibility of state and local authorities, and processes for dealing with those types of violations already exist. This proposal appears to duplicate existing laws and processes.

Second, this proposal has greater likelihood of being accompished without federal involvement than other measures discussed in this section; that is, agreements of the type proposed probably could be achieved between the tribe and the lessees. The lessees' costs would be minimal, and agreements arrived at voluntarily probably would be as effective as substantively parallel required agreements. Federal imposition might be neither warranted nor useful. However, the tribe has concluded that existing law enforcement mechanisms are inadequate, that voluntary agreements are not feasible, and that federal involvement in on-reservation law enforcement already is well established.

Proposed Measure 4: Environmental Protection

Proposal

The Northern Cheyenne Tribe proposes a lease stipulation for environmental protection on the reservation. The proposed stipulation would require establishment of a program to monitor air quality, visibility, water quality, water quantity, and biological and other resources that might be adversely affected by coal leasing and development. The proposal calls for baseline monitoring for a reasonable period before construction and for ongoing monitoring throughout the life of the project.

The stipulation proposes the program be conducted under an agreement among the tribe, the coal lessee, and all federal and state agencies with pollution control jurisdiction over the project. The agreement, which would be subject to approval by the Secretary of the Interior, would include the following provisions:

Comprehensive monitoring of reservation resources using state-of-the-art monitoring equipment and techniques, designed and conducted by qualified professionals who would analyze the results

Recruitment, training, and employment of tribe members and families to operate the monitoring program

Establishment of an environmental monitoring committee with members from the tribe, the lessee, and involved state and federal agencies

Arrangements for remedies in the event of violations of air or water quality standards or impairment of resources resulting from construction or operation of a project

Funding by the lessee to cover the cost of the monitoring programs and the expenses of the tribe's representatives on the committee

Discussion

Federal coal leasing and development will not occur on the Northern Cheyenne Reservation or on lands owned or controlled by the tribe. For that reason, any environmental impacts that would affect the tribe under any alternative would be off-site impacts.

One coal tract included in the alternatives, Downey Coulee, adjoins the north boundary of the Northern Cheyenne Reservation. The Northwest Otter Creek tract is 2 miles east of the reservation; Ashland (Decker-Birney) is 8 miles east. All other tracts are more than 12 miles from the reservation boundary.

Six of the 11 Montana tracts included in the alternatives are maintenance tracts. It is expected that they would be developed in association with existing coal mines. Therefore, they would not significantly increase impacts from coal development; rather, they would extend the time that any existing impacts might continue.

Only the Mud Springs tract has been considered for development of a coal-fired generator on the site. Coal from the other tracts, if they were leased, would be transported out of the region.

The PEDCo air quality model did not forecast violations or cumulative violations of air quality standards from the proposed Mud Springs generator (PEDCo 1983).

A requirement already exists for monitoring effects on air quality. State statutes require an applicant to conduct air quality monitoring for a minimum of one year before obtaining a PSD permit. After the permit is granted, continuous monitoring is required during mining to determine if air quality violations are occurring.

Only the Downey Coulee tract has been projected to affect water quantities on the reservation. All other tracts are outside the 2 to 3 mile radius where effects normally occur. State statutes require groundwater monitoring around surface mining operations and replacement of water quantities lost; that is, water lost through damage to existing wells on the vicinity of surface mines must be replaced.

The increase in TDS in the Tongue River is projected to range from 1.4% to 7.2% for the six alternatives. Potential degradation of water quality on the reservation would occur only from tracts on the Tongue River drainage. Discharges from other tracts included in the alternatives flow away from reservation boundaries. State statutes requires mine permittees to monitor groundwater and surface water and to comply with water quality standards.

Neither the regional EIS nor the Northern Cheyenne Tribe identified coal-related impacts to biological or other resources. The main reason for this finding is that coal development will not occur on reservation lands.

Proposed Measure 5: Impact Assistance

Proposal

The Northern Cheyenne Tribe proposes two alternative stipulations aimed at responding to the issue of impact funding. The first alternative would make the following provisions:

> Lessees would be required to contribute to the tribe for planning and providing public service and facilities on the reservation.
>
> Contributions would be calculated by taking the bid royalty funds generated by the lease, dividing that figure by the non-reservation resident population of Big Horn, Rosebud, and Powder River counties, and then multiplying that number by the resident population of the reservation.
>
> Contributions would be provided to the tribe in concert with federal royalty payments.
>
> This funding would be implemented through an agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior.

The requirements of the second alternative would be as follows:

> Lessees would be required to contribute to the tribe for planning and public services and facilities on the reservation.
>
> The contribution would be based on the previous year's tribal expenditures for reservation services and facilities, divided by the total reservation population.
>
> The per capita expenditure described above would be matched by the lessee for each project employee and family member residing on the reservation. Furthermore, the lessee would contribute one-third of this per capita expenditure level for each employee residing off the reservation.
>
> The program would be implemented through an agreement between the tribe and the lessee, subject to approval by the Secretary of the Interior. This alternative would cover the following tribal expenditures: education, ambulance service, health care, alcoholism and drug abuse treatment, law and order, tribal court, rural officers, recreational facilities, transportation, shelter home for children, day care, elderly residence and care, garbage canister program, utility commission, and tribal government.

Discussion

The first alternative would essentially be a mechanism to ensure that the tribe would receive per capita funding equivalent to the level received by state government, relative to non-Indian residents of the three-county area. The second alternative is a cost-sharing approach that would ensure that the lessee would bear costs associated with project-related residents. The tribe believes this would compensate for spillover effects from in-migrants living off-reservation in southeastern Montana and in the Sheridan area of Wyoming.

The tribe has expressed no preference between the alternatives proposed. Evaluation of these proposals is difficult. Policy and legal questions of some complication are involved. The following factors are among those that might be considered.

The actions of Congress in making decisions on the distribution of mineral royalties imply that federal funding involvement should be limited to a proportionate return of the local revenues to state governments. The Northern Cheyenne Tribe has asserted that the Secretary of the Interior, given trust authority, has unequivocal authority to attach stipulations to leases in the manner described in the proposals, even though that authority is not expressed.

Equity questions between non-Indian, nonreservation residents in the area and the Northern Cheyenne Tribe and its members deserve attention. For example, the state's application of royalty funds from the federal government may not be entirely consistent with the location of the effects of mining. The first alternative apparently is based on the idea that these funds are targeted more or less exclusively to the areas affected by mining.

Jurisdictional and taxation issues between the state of Montana, the counties, and the tribe are unresolved. Under the second alternative, a lessee would bear the costs of providing service in a jurisdiction where neither its operation nor its employees was located.

Tribal qualification for state severance tax funds is now secure, but limited. The tribe does not have access to other funding sources that are available to other jurisdictions, such as federal rentals, bid bonuses, and property taxes.

The extent to which the tribe bears responsibility for services and facilities used by non-Indian residents of the reservation is restricted relative to a broader array of services and facilities provided by other local governments in the area. However, the tribe has listed the following programs that are at least partially funded by the tribe and which non-Indians may use: roads, law enforcement, tribal court, recreation areas, utility services, emergency medical services, and firefighting. Non-Indians married to Indians formerly were eligible for tribal health care; however, it appears that restrictions recently have been placed on this eligibility. Non-Indian eligibility for housing benefits provided by the Department of Housing and Urban Development, the Bureau of Indian Affairs, and the tribe are very limited. The tribe has concluded that coal development in the region has increased the tribe's cost of responding to Northern Cheyenne needs, independent of non-Indian settlement on the reservation. A primary example is law enforcement.

Legal authority for attaching stipulations of this type remains to be clearly established. It appears to be somewhat less secure than the possible measures such as employment preference. However, the tribe has concluded that this authority is unequivocal.

Tribal sovereignty in land use control is established. While it may be difficult to implement, the tribe has the power to exclude the siting of subdivisions and the like on the reservation. Such action would largely reduce the need for the measures proposed. However, the tribe has concluded that these actions are not realistic.

Given that there are several ongoing and proposed operations in the area, evaluation of baseline populations and populations attributable to any particular construction project or mining operation would be technically difficult and imprecise. It would require a monitoring program of considerable scale. A funding source, or sources, for such an effort has not been identified.

It would be difficult to evaluate the effect that attaching these stipulations to individual leases would have on the market value of the coal resource. However, the tribe has concluded that this is not a valid consideration.

The principal available alternative to requiring agreements like those proposed would be a voluntary approach without federal participation. The effectiveness of such approaches is uncertain. The tribe has concluded that such an approach would be ineffective.

Northern Plains Resource Council Proposal

Proposal

For provision of impact information and assistance to local units of government, the Northern Plains Resource Council proposes that each lessee submit a plan to all potentially affected Montana units of government (school districts, counties, municipal governments, water and sewer districts). The plan would address two factors, (1) the expected fiscal and social effects of construction and operation of proposed mines and all associated facilities on the affected area and (2) proposed mitigating measures to be undertaken by the lessee to address the impacts.

The plan would specifically consider prepayment of taxes, grants, and other measures available to assist local government units. If local government officials did not agree with the assessment or the proposed mitigation, then the BLM Miles City District Manager would appoint an arbitrator with the advice and consent of the Montana Coal Board. The results of any agreement between local units of government and the lessee would be appended to the lease and would become enforceable.

Discussion

The two distinct elements of this proposal, taken together, are similar in concept to the Wyoming means of responding to off-site social and economic effects, the siting process. However, the process proposed by the NPRC would involve the participation of the federal government.

The first element is essentially an information-sharing mechanism. As such, it is parallel to aspects of the permit application processes required by Montana laws for mines (the Strip and Underground Mining and Reclamation Act) and facilities (Major Facility Siting Act). Those permitting processes include social and economic forecasts of the type proposed. Attachment of this element of the proposed stipulation to leases would appear to duplicate such ongoing efforts in Montana.

The second element extends well beyond the distribution of information to the distribution of funds. Prepayment of taxes is now authorized for some mining operations in Montana. However, this authorization is apparently limited to the county unit of government for operations employing a minimum annual average of 100 persons.

Montana school superintendents can require an educational impact statement from operators within their jurisdiction. Such a statement is evidence toward bringing bond issues before the voters. Approval of such issues permits the district to exceed its bonding limitation. The developer would then pay the excess in principal and interest above the limitation.

Finally, the Montana Coal Board is designed to respond, with severance tax funds, to fiscal problems brough on by mining activities. Funds are directed to a variety of units of government.

The NPRC's proposal reflects an apparent belief that Montana mechanisms are not comprehensive enough to deal with growth at the local level and that there are jurisdictional mismatches between the location of operations and the location of consequences. Thus, federal intervention in these matters is proposed.

It appears that Montana has adequate authority to implement the information-sharing component of this proposal in its process for permitting coal operations. Information available during that process would be adequately specific to allow much more precise forecasting that could be accomplished at the leasing stage.

The regulatory environment in Montana for requiring lessees to implement the second element of the proposal is less consistent and comprehensive than that for implementing the first component. It is possible, if not likely, that affected local units of government would not have the authority or the access to funding required to respond to rapid growth in a timely manner.

Implementation of this proposed stipulation would require the design of an administrative process within the Department of the Interior that does not exist at this time.

CHAPTER 6: CONSULTATION AND COORDINATION

PREPARERS

Team Leader. Chuck Wilkie, Coal Team Leader, Casper District. B.S., Range Management, University of Wyoming; M.S., Range Management, University of Nevada. Previously Area Manager, Platte River Resource Area, Wyoming; 18 years with BLM.

Geology and Minerals. Wayne Sutherland, Geologist, Buffalo Resource Area. B.A, M.A, Geology, University of Wyoming. Four years with BLM; one year as Mine Geologist, Pathfinder Mines Corporation.

Soils and Reclamation; Vegetation. Jim Collins, Soil Scientist, Casper District. B.A., Biology, University of New Orleans; M.S., Agronomy, Louisiana State University. Three years with BLM.

Water Resources. Doug Stern, Hydrologist, Casper District. B.A., Chemistry, Western Washington University; M.S., Forest Hydrology, University of Washington.

Land Use; Visual Resources; Noise; Transportation Facilities. Darrel Schwilling, Landscape Architect, Casper District. B.L.A., Kansas State University. Three years with BLM.

Wildlife. Mike McLellan, Wildlife Biologist, Casper District. B.S., Wildlife Management, Humboldt State University, California. Seven years with BLM; previously Natural Resource Specialist, Sonoma-Gerlach Resource Area, Winnemucca (Nev.) District.

Cultural Resources. Kathleen O'Neal Gear, Archeologist, Casper District. B.A., M.A., University of California, Los Angeles; Ph. D. candidate in Ethnohistory, UCLA. Previously Senior Museum Preparator for Museum of Cultural History, Los Angeles; City Historian, Planning Office, Cheyenne, Wyoming. Two years with BLM, serving as State Historian for Wyoming State Office, then as Casper District Coal Team Archeologist.

Air Quality. James E. Rasmussen, Program Analyst, Lewistown District. B.A., Biology, Mount Marty College, South Dakota; M.S., Environmental Science, University of Oklahoma. Previously Environmental Engineer, Montana State Office, BLM; Environmental Coordinator/Surface Protection Specialist, Socorro (N. Mex.) District; Environmental Engineer, U.S. Environmental Protection Agency.

Air Quality. Bud Rolofson, Meteorologist, Division of EIS Services, Denver. B.S., Meteorology, Metropolitan State College, Denver. Two years with BLM as climatologist for Energy Minerals Resource Inventory and Analysis program; one year as Meteorologist/Air Quality Specialist for Divsion of EIS Services, Denver.

Employment and Income; Population and Housing; Local Revenues and Expenditures; Community Services. Laurence E. Marks, Economist, Casper District. B.S., Farm and Ranch Management; M.S., Agricultural Economics, Colorado State University. BLM, three years; Farmers Home Administration, USDA, one year; Foreign Agricultural Service, USDA, four years.

Sociology. Paul B. Myers, Sociologist, Denver Service Center. B.A., Sociology, University of Texas at Austin; M.A, Sociology, University of Kentucky; Ph. D., Resource Development, Michigan State University. Eight years with BLM.

Sociology. Susan Light Davidson, Sociologist, Miles City District, Montana. B.S., Rural Sociology, University of Wisconsin, Madison; M.A., Sociology, Colorado State University. Four years as planner for various state, county, and city agencies.

Editing. Lou Layman, Writer-Editor, Casper District. B.S., Journalism, University of Colorado. Four years as editor of BLM documents; two years as writer-editor of planning and environmental documents for National Park Service, Denver.

Graphics. Darrel Schwilling, Landscape Architect, Casper District.

Word Processing. Patricia Hiller, Clerk-Typist, Casper District. Attended Casper College, Bookkeeping. One year with BLM; four years with Wyoming Machinery.

Word Processing. Cloetta Schroeder, Clerk-Typist, Casper District. Associate Degree in Data Processing, Casper College; Certificate of Secretarial Science. BLM, 3½ years.

Cartographic and Typesetting Services provided by BLM Wyoming State Office, Cheyenne.

COOPERATING AGENCIES

The Forest Service, U. S. Department of Agriculture, assisted directly in preparation of site-specific analyses for tracts in the Thunder Basin National Grassland. The Forest Service also reviewed the draft document.

The Office of Surface Mining Reclamation and Enforcement, U. S. Department of the Interior, reviewed the draft document.

CONSULTATION

In addition to the scoping meetings described in chapter 1, many informal consultations were held with various federal, state, and local governments and with Indian tribal councils. The many BLM specialists assigned to the project have held a broad range of "one-on-one" meetings. The information received has been incorporated into the EIS as appropriate.

Formal consultation for the EIS consisted of the following:

Consultation with the State Historic Preservation Officers of Wyoming and Montana under section 106 of the National Historic Preservation Act.

Submission to the U.S. Fish and Wildlife Service of a biological assessment indicating no significant impacts would occur to threatened and endangered species under the proposed action

Results of the cultural resource consultations are reflected in the EIS. Final evaluation of the biological assessment in Wyoming is pending. Evaluation of the Montana biological assessment has been completed.

DISTRIBUTION

Federal Agencies

Department of Agriculture
  Farmers Home Administration
  Forest Service
  Soil Conservation Service

Department of Defense
  Department of the Army, Corps of Engineers

Department of Energy

Department of the Interior
  Bureau of Indian Affiars
  Bureau of Mines
  Bureau of Reclamation
  Fish and Wildlife Service
  Geological Survey
  National Park Service
  Office of Surface Mining Reclamation and Enforcement

Environmental Protection Agency

General Accounting Office

Interstate Commerce Commission

Small Business Administration

Indian Tribes

Crow Tribal Chairman
Northern Cheyenne Tribe

State Agencies

Governor's Clearinghouse, Wyoming
Montana State Clearinghouse
Governor Herschler, Wyoming
Governor Schwinden, Montana

Local Governments

Campbell, Converse, and Sheridan County Commissioners or Planning Departments, Wyoming

Big Horn, Powder River, and Rosebud County Commissioners or Planning Departments, Montana

Cities and Towns of Douglas, Gillette, Ranchester, and Sheridan, Wyoming

Cities and Towns of Broadus, Forsyth, Hardin, and Miles City, Montana

Special Interest Groups

Audubon Society
Chamber of Commerce, Gillette, Wyoming
Chamber of Commerce, Sheridan, Wyoming
Citizens for Orderly Energy Development
Council of Energy Resource Tribes
Earthtech
Ecology and Environment
Environmental Policy Institute
Friends of the Earth
Montana Senior Citizens Association
National Wildlife Federation
Natural Resources Defense Council
The Nature Conservancy
Northern Plains Resource Council
Powder River Basin Resource Council
Public Lands Institute
Sierra Club
Tongue River Resources Council
Trout Unlimited
The Wilderness Society
Wyoming Heritage Society
Wyoming Mining Association
Wyoming Outdoor Coordinating Council
Wyoming Stockgrowers Association
Wyoming Wildlife Federation
Wyoming Woolgrowers

Other Organizations and Individuals

Copies of this EIS have been sent to a number of individuals, companies and organizations not listed above.

APPENDIX A: NET ENERGY ANALYSIS

INTRODUCTION

A net energy analysis was conducted for Powder River coal tracts at the site-specific analysis and cumulative analysis stages of coal activity planning. The results of the analysis for each tract are shown in the individual tract profiles.

Both types of analyses used the ratio of Btus expended in mining to the Btus recovered per pound of coal. A net energy analysis factor of 37.7 Btus expended to produce a pound of coal was used as directed in BLM Washington Office instruction memorandum 79-282.

METHODOLOGY

Coal Btu content in the tracts selected ranged from 7,800 to 9,500 per pound for all leasing alternatives. To calculate net energy ratios by alternative, we multiplied the weighted average Btu content per tract by the total coal reserves in the tract, obtaining a weighted value. We then took the sum of these values for all tracts in a given alternative and divided it by the sum of the total coal reserves to get a weighted Btu content by alternative. This weighted Btu value was then divided by 37.7 to obtain ratios by alternative.

NET ENERGY RATIO FOR EACH ALTERNATIVE

Alternative	Total Reserves[1] (in billions of tons)	Weighted Btu Value per pound	Net Energy Ratio
1	No leasing		
2	1.475	8,760	232 to 1
3	2.122	8,694	230 to 1
4	3.466	8,710	231 to 1
5	3.976	8,729	231 to 1
6	6.131	8,511	225 to 1

[1] The totals are for all reserves in the tract, including federal, state, and private coal.

CONCLUSION

Favorable energy balances were found for all alternatives considered. Differences between ratios for the various leasing alternatives were not great enough to formulate meaningful conclusions about which alternative would be best.

APPENDIX B: ENERGY-RELATED INDUSTRIAL DEVELOPMENT IN THE POWDER RIVER REGION

(projects included in baseline)

PRODUCING COAL MINES

Colstrip (Western Energy)
Big Sky (Peabody)
Absaloka (Westmoreland)
Coal Creek
Spring Creek (Nerco)
Decker—East and West (Peter Kiewit)
Big Horn (Peter Kiewit)
North Rawhide (Carter)
Eagle Butte (AMAX)
Fort Union (Delzer Construction)
Clovis Point (Kerr-McGee)
Wyodak (Wyodak)
Caballo (Carter)
Belle Ayr (AMAX)
Cordero (Cordero)
Jacobs Ranch (Kerr-McGee)
Black Thunder (Anaconda)
Dave Johnston (Glenrock Coal)
Buckskin (Shell)
Coal Creek (Anaconda)

NONPRODUCING COAL MINES

Montco-Nance (Montco)
CX Ranch (Consolidation-Chevron)
Ash Creek (Ash Creek Mining)
Black Mountain (Black Mountain)
Dutchman (JMT)
Wildcat Creek (Gulf)
Dry Fork (Phillips)
South Rawhide (Carter)
East Gillette (Kerr-McGee)
Peabody (Peabody)
Caballo Rojo (Mobil)
Wymo Fuels (Wymo)
North Rochelle (Shell Oil)
Rochelle (Peabody)
Antelope (NERCO)
Coal Creek (Wesco Resources)
Cook Mountain (Thermal Energy)
Rocky Butte (Texas Energy)
Keeline (Neil Butte)
Crow-Shell (Shell)
North Antelope (North Antelope Coal Company)

PREFERENCE RIGHT LEASE APPLICATIONS

Ulm Project (Fred C. Woodson)—2 PRLAs
Wildcat Creek Area (Gulf)—7 PRLAs
Thunderbird Project (Western Fuels)—16 PRLAs
Thunderbird II (Wold-Jenkins)—11 PRLAs
South Gillette (Peabody)—6 PRLAs (6 PRLAs were rejected and are under appeal)
Belle Fourche (John Wold)—1 PRLA (1 PRLA was rejected and is under appeal)
East Black Thunder (Anaconda)—3 PRLAs
Rochelle Area (Peabody)—5 PRLAs
North Antelope (NERCO)—2 PRLAs
South Antelope (Peabody)—1 PRLA
Dull Center (Peabody)—2 PRLAs
Sand Draw (Peabody)—5 PRLAs
Stevens North (Western Fuels)—3 PRLAs
Stevens South (Western Fuels)—1 PRLA
Southern Powder River (CDT)—2 PRLAs

COAL EXCHANGES

Big Horn
Gulf
Belco
Kerr-McGee
Whitney Benefits
Peabody Coal
Consolidation Coal

POWER PLANTS

Colstrip 1
Colstrip 2
Neil Simon
Wyodak

Osage
Dave Johnston
Colstrip 3
Colstrip 4
Missouri Basin Project

REFINERIES

Osage
Wyoming
Texaco
Little America
Glenrock
Amoco

URANIUM MINE AND MILL AREA

Irigary in situ
Greasewood Creek Mine
North Butte Mine and Mill
PINTEC and Thunderbird joint in situ
Reno Road in situ
Charlie Ore Body Mine and Mill
Moore Ranch Mine
Sand Rock Mill
Bear Creek Mine and Mill
Open Pit and Section 34 Mines
Teton Exploration in situ
SPRB Mill
Highland Mine and Mill
Nine Mile Lake in situ
Morton Ranch Mine and Mill
Bill Smith Mine

BENTONITE MINE AND MILL AREA

American Colloid Mine and Mill
NL-Industries Mine and Mill
International Mineral Co. Mine and Mill
Federal Bentonite Corp. Colony Mine and Mill
American Colloid Mine
Federal Bentonite Division Mine
Benton Clay Corp. Mine
Kaycee Bentonite Corp. Mine
Benton Clay Corp. Mill
Kaycee Bentonite Corp. Mill

OIL AND GAS

Regional Developments

RELATED ENERGY DEVELOPMENT

ETSI Coal Slurry Pipeline
Tongue River Railroad
Chicago and North Western Railroad Connector

APPENDIX C: MITIGATION REQUIREMENTS

INTRODUCTION

Lessees will be required to develop their federal leases in compliance with all applicable federal, state, and local laws and regulations. These are considered to be in-place constraints to a lessee's activities. Therefore, enforceable statutes, performance standards, and other license requirements are considered part of proposed federal actions under all alternatives and are applicable to all coal tracts. (Refer to the "Legislation and Regulations" section of chapter 1 of this document for a discussion of the laws pertaining to federal coal leasing.)

In addition, through the land use planning and activity planning processes, the BLM has considered the practicable means to avoid or minimize environmental harm resulting from the alternative leasing actions, above and beyond the standards that are already required by existing regulations or laws. The following mitigating measures are considered to be real, committed, and legally enforceable. The general mitigating measures apply to all tracts under all leasing alternatives. The tract-specific measures apply only to particular tracts and the alternatives in which they occur. Additional mitigating measures, if warranted, may be identified as a result of the EIS process.

MEASURES APPLIED TO ALL TRACTS

Cultural Resources

a. Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the authorized officer of the appropriate surface management agency on portions of the mining plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease related activities and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archeologist, historian, or historical architect, as appropriate) approved by the authorized officer of the appropriate surface management agency, and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Office of Surface Mining (OSM) and the authorized officer of the appropriate surface management agency (or only to the surface management agency if activities are associated with coal exploration outside an approved mining permit area). The lessee shall undertake measures, in accordance with instructions from OSM (or the surface management agency if activities are associated with coal exploration outside an approved mining permit area), to protect cultural resources on the leased land. The lessee shall not commence the surface-disturbing activities until permission to proceed is given by OSM (or the surface management agency if activities are associated with coal exploration outside of approved mining permit area.)

b. The lessee shall protect all known cultural resource properties within the leased area from lease related activities until the cultural resource mitigating measures can be implemented as part of an approved mining and reclamation plan or exploration plan.

c. The cost of conducting the inventory, preparing reports, and carrying out mitigating measures shall be borne by the lessee.

d. If cultural resources are discovered during operations under a lease, the lessee shall immediately bring them to the attention of OSM, the appropriate state regulatory agency, or the authorized officer of the surface managing agency if OSM is not available. The lessee shall not disturb such resources except as may be subsequently authorized by OSM, the state regulatory agency, or the authorized officer of the appropriate surface management agency. Within two (2) working days of notification, OSM, the state regulatory agency, or the authorized officer of the appropriate surface management agency will examine or have examined any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the authorized officer of the surface managing agency.

e. All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

Paleontological Resources

a. Before undertaking any activities that may disturb the surface of any leased lands, the lessee shall contact the surface managing agency to determine whether the authorized officer will require the lessee to conduct a paleontological appraisal of the mining plan and adjacent areas, or exploration plan areas, that may be adversely affected by lease related activities. If the authorized officer determines that one is necessary, the paleontological appraisal shall be conducted by a qualified paleontologist approved by the authorized officer of the surface managing agency, using the published literature and, where appropriate, field appraisals for determining the possible existence of larger and more conspicuous fossils of significant scientific interest. A report of the appraisal and recommendations for protecting any larger and more conspicuous fossils of scientific interest on any leased lands so identified shall be submitted to the authorized officer (AO) of the surface managing agency (BLM, if the surface is privately owned). When necessary to protect and collect the larger and more conspicuous fossils of significant scientific interest on any leased lands, the lessee shall undertake the measures provided in the approval of the mining and reclamation plan or exploration plan.

b. The lessee shall not knowingly disturb, alter, destroy, or take any larger and more conspicuous fossils of significant scientific interest and shall protect all such fossils with the measures included in the approval of the mining and reclamation plan or exploration plan.

c. The lessee shall immediately bring any such fossils that might be altered or destroyed by his operation to the attention of OSM or the authorized officer of the surface managing agency, as appropriate. Operations may continue as long as the fossil specimen or specimens would not be seriously damaged or destroyed by the activity. OSM or the AO, as appropriate, shall evaluate or have evaluated such discoveries brought to his attention and, within five (5) working days, shall notify the lessee what action shall be taken with respect to such discoveries.

d. All such fossils of significant scientific interest shall remain under the jurisdiction of the United States until ownership is determined under applicable law. Copies of all paleontological resource data generated as a result of any lease term requirements will be provided to OSM or the AO of the surface managing agency, as appropriate.

e. The cost of any required salvage of such fossils shall be borne by the United States.

f. These conditions apply to all such fossils of significant scientific interest discovered within any lease whether discovered in the overburden or in the coal seam or seams.

Existing Rights

The lease is subject to valid existing rights. Any negotiations for relocation or displacement are between the lessee and the existing right holder, except such negotiations must be approved by the authorized officer of the surface managing agency.

Soils

a. It is required that the B horizon (where present) and soil that lies above it be segregated from the underlying material.

b. It is required that B horizon material be handled only when it is dry.

Survey Markers

The lessee must protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage during operations on the lease areas. If any monuments, corners, or accessories are destroyed, obliterated, or damaged by this operation, the lessee will hire an appropriate county surveyor or registered land surveyor to reestablish or restore them at the same locations. Surveying procedures must be carried out in accordance with the *Manual of Surveying Instruction for the Survey of Public Lands in the United States,* and the surveyor will record the survey in the appropriate county records and send a copy to the authorized officer.

MEASURES FOR WYOMING TRACTS

Youngs Creek

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Youngs Creek and Ash Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining. Floodplains associated with these streams must be protected and provided for in accordance with the law and current regulations.

3. No surface occupancy is permitted within 100 feet of the right-of-way boundary for Wyoming Highway 338, which passes through the east side of the tract. This measure will become void in the event that the highway is relocated off the tract at a later date.

4. Land within the buffer area around the existing prairie falcon and bald eagle nesting sites is classified as unsuitable for coal mining. Land included within the Youngs Creek tract and within the buffer area is described as follows:

   T58N, R83W
   Section 19: Lots 1, 2, 3, 4, 5, 6, N½NE¼SW¼, N½NW¼SE¼, S½NE¼, SE¼NW¼
   Section 20: Lots 3, 4, SW¼NW¼
   Section 31: Lot 2

   T58N, R84W
   Section 24: Lot 1, E½SE¼NE¼, NE¼NE¼SE¼

5. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for burrowing owl and Lewis' woodpecker, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the permit application package. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and Lewis' woodpeckers will not decline in the lease area.

Hidden Water

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Slater Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Slater Creek must be protected and provided for in accordance with the law and current regulations.

3. Land within the buffer area around the golden eagle nesting sites is classified as unsuitable for coal mining. Land included within the Hidden Water tract and within the buffer area is described as follows.

   T57N, R84W
   Section 2: Lot 4
   Section 3: Lots 1, 2, 3, NE¼NE¼SW¼

4. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habat for burrowing owl and Lewis' woodpecker, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and Lewis' woodpeckers will not decline in the lease area.

Hay Creek

1. Hay Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Hay Creek must be protected and provided for in accordance with the law and current regulations.

2. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for burrowing owl and prairie falcon, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and prairie falcons will not decline in the lease area.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Calf Creek

1. Calf Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Calf Creek must be protected and provided for in accordance with the law and current regulations.

2. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and burrowing owl, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and burrowing owls will not decline in the lease area.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Mount Logan

1. Portions of the Belle Fourche River passing near or through the Mount Logan tract have been identified as possible alluvial valley floors. AVFs may only be mined subject to mitigating measures for AVF protection that are made a part of an approved mine plan. Determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development.

2. No surface occupancy is permitted within 100 feet of the right-of-way boundary for the Burlington Northern railroad, which passes through the tract.

3. One pair of nesting golden eagles has recently been moved onto the Mount Logan tract from an adjoining coal lease. A buffer area around this nest site will not be classified as unsuitable pending continued activation of the existing mitigation plan.U.S. Fish and Wildlife Service and the lessee should continue to monitor this situation and formulate modifications to the mitigation plan.

The pair of golden eagles previously nesting on the ground in T46N, R71W, Section 9, have constructed a tree nest in Section 10 of the same township and range. Land within the buffer area around the golden eagle nesting sites is classified unsuitable for coal mining. Land within the Mount Logan tract and within the buffer area is described as follows:

T46N, R71W
  Section 10: SW¼NW¼, E½NW¼SW¼, NE¼SW¼, NW¼SE¼, W½SE¼SE¼, SE¼SE¼SE¼.

4. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Kintz Creek

1. No surface occupancy is allowed within the Kintz Cemetery or a 100-foot buffer area adjoining the cemetery. The location of the cemetery is T45N, R70W, Section 20, NE¼NE¼SE¼.

2. Kintz Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Kintz Creek must be protected and provided for in accordance with the law and current regulations.

3. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawks and golden eagles, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and golden eagles will not decline in the lease area.

Donkey Creek

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Timber Creek

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Porcupine

1. The buffer areas for golden eagle nests that are near the Porcupine tract fluctuate because the pair of golden eagles has nested in three different locations in different years. Land within the buffer areas will not be classified as unsuitable pending submission of an acceptable mitigation plan by the lessee and approval of such a plan by the Wyoming Game and Fish Department and the Fish and Wildlife Service.

2. Porcupine Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Porcupine Creek must be protected and provided for in accordance with the law and current regulations.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the FS.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Ridgerunner

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any

suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Land within the buffer area around the golden eagle nest site is classified as unsuitable pending submission of an acceptable mitigation plan. Land included within the Ridgerunner tract and within the buffer area is described as follows.

   T41N, R71W
   Section 14: SW¼SW¼NE¼, SE¼NW¼, S½NE¼NW¼

3. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and mountain plover, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Forest Service.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the FS, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and mountain plovers will not decline in the lease area.

Thundercloud

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and burrowing owl, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Forest Service, the U. S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the FS, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and burrowing owls will not decline in the lease area.

MEASURES FOR MONTANA TRACTS

Ashland (Decker-Birney)

1. Otter Creek, Home Creek, and Threemile Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining. Floodplains associated with these creeks must be protected and provided for in accordance with the law and current regulations.

Northwest Otter Creek

1. Otter Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, extent, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Otter Creek must be protected and provided for in accordance with the law and current regulations.

Hanging Woman Creek

1. The lessee will be required to monitor and inventory all prairie dog towns in the lease area for black-footed ferrets. Colonies must be mapped on topographic maps, and each colony must be surveyed using black-footed ferret survey procedures recommended by the U. S. Fish and Wildlife Service. Ferret surveys must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move into an area during the period between completion of surveys and the start land disturbance. Ferret surveys are considered valid for one year. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.
2. If the mitigation plan covering the loss of two sage grouse leks, approved in 1982, is allowed to lapse, the leks and surrounding habitat will be designated unsuitable for mining unless another mitigation plan is developed and agreed upon by the state of Montana and the lessee.
3. Hanging Woman Creek, Trail Creek, and the East Fork of Trail Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject tomitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining.

Mud Springs

1. The tract contains one occupied dwelling, an operating schoolhouse, and approximately 4 miles of a county road. The area within a 300-foot perimeter of the dwelling and the schoolhouse cannot be mined unless an agreement is reached between the affected parties and the lessee. The county road right-of-way, plus a buffer zone extending 100 feet outside of each edge of it, cannot be mined unless the Powder River County Commissioners and the lessee agree to a relocation plan.
2. The lessee will be required to monitor and inventory all prairie dog towns in the lease area for black-footed ferrets. Colonies must be mapped on topographic maps, and each colony must be surveyed using black-footed ferret survey procedures recommended by the U. S. Fish and Wildlife Service. Ferret surveys must be scheduled as close to con-

struction as is reasonable to minimize the possibility of missing ferrets that might move into an area during the period between completion of surveys and the start land disturbance. Ferret surveys are considered valid for one year. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

3. Mud Springs and Bear creeks have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining.

Downey Coulee

1. Any successful bidder must show, to the satisfaction of the state of Montana, that the mitigation plan for the buffer around the identified sharp-tailed grouse lek on the Downey Coulee tract will ensure that all or stipulated methods of mining will not have significant long-term impact on the areawide population of this species. Reclamation and management of reclamation areas must also provide suitable post-mining habitat for sharp-tailed grouse. If the state of Montana does not agree that mitigation and reclamation are acceptable, the subject buffer zone will be dropped from the lease as unsuitable at the mine plan stage. This stipulation does not preclude the Montana Department of State Lands from enforcing its selective denial and unsuitability process.

Colstrip Area C

1. Approximately 2¼ miles of a county road lie within the tract. The road right-of-way, plus a buffer zone extending 100 feet outside each edge of the right-of-way, cannot be mined unless the lessee and the Rosebud County Commissioners agree to a relocation plan. The county road is in portions of Section 32, T2N, R40E, and Section 6, T1N, R40E.

2. Any successful bidder must show, to the satisfaction of the state of Montana, that the mitigation plan for the buffer around the identified sharp-tailed grouse lek on the Colstrip C tract will ensure that all or stipulated methods of mining will not have significant long-term impacts on the areawide population of this species. Reclamation and management of reclamation areas must also provide suitable post-mining habitat for sharp-tailed grouse. If the state of Montana does not agree that mitigation and reclamation are acceptable, the subject lek will be dropped from the lease as unsuitable at the mine plan stage. This stipulation does not preclude the Montana Department of State Lands from enforcing its selective denial and unsuitability process.

Wolf Mountain Maintenance

1. Approximately ¾ mile of Montana State Route 314 lies across the southeast corner of the tract in Section 20, T9S, R40E. The road right-of-way, plus a buffer zone extending 100 feet outside each edge of the right-of-way, cannot be mined unless the lessee and the state of Montana agree to a relocation plan.

2. Squirrel Creek has been identified as an alluvial valley floor by the state of Montana and the Office of Surface Mining. The portions so identified are unsuitable for mining.

North Decker I

1. Approximately two miles of Montana State Route 314 and ½ mile of a railroad spur lie within the North Decker I tract. The portion of the highway right-of-way that crosses private surface, plus a buffer of 100 feet outside each edge of the right-of-way, is unsuitable for mining. For the portion of the highway on public surface, only the area within the right-of-way is unsuitable for mining. Mining can be allowed in this road right-of-way only if an agreement is reached between the lessee and the state of Montana. The area within the railroad right-of-way that crosses public surface is also unsuitable for mining unless the lessee reaches an agreement with the railroad owner.

Montana State Route 314 lies in portions of Section 34, T8S, R40E, and Section 3, T9S, R40E. The railroad crosses public land in the SE¼SW¼ of Section 34, T8S, R40E, and the NW¼SE¼ of Section 3, T9S, R40E.

APPENDIX D: VISUAL MANAGEMENT SYSTEMS

FOREST SERVICE VISUAL MANAGEMENT SYSTEM

Variety Classes

Variety classes are based on the premise that the more variety there is in the landscape, the higher the scenic quality is. The three variety classes are as follows:

Class A (distinctive) areas are areas in which features (landforms, vegetation, water, color) are not common in the character type or are unusual or outstanding.

Class B (common) areas are those in which features contain variety in form, line, color, and texture but are fairly common within the character type and are not unusual or outstanding.

Class C (minimal) areas are those in which features are common to the character type and contain little variety.

Quality Objectives

Quality objectives determine the visual management of the landscape. Each objective determines the extent to which the basic elements of the landscape will be modified or altered. The five possible objectives are as follows:

Preservation (P) is applied to special areas such as wilderness or primitive areas or to some management units that are unique but for which special classification is not justified. The only management activities allowed in "P" areas are low visual impact recreation facilities.

The retention (R) objective allows for activities that repeat form, line, color, and texture but are not evident within the landscape.

The partial retention (PR) objective allows for activities that repeat form, line, color, and texture but remain visually subordinate to the characteristic landscape.

The modification (M) objective allows for activities that visually dominate the landscape, but they must repeat or be compatible with the natural characteristics of the landscape.

The maximum modification (MM) objective allows management activities to dominate the landscape, but they must repeat visual characteristics when viewed as background. When viewed as foreground or middleground, they may appear not to borrow completely from the natural characteristics. Alterations may appear to be out of scale or may contain inharmonious details when viewed as foreground or middleground.

More detailed information on the Forest Service's-visual management system appears in a publication available from the Government Printing Office, Washington (USDA, FS 1979a).

BLM VISUAL RESOURCE MANAGEMENT

Scenic quality classes are defined by a system rating seven key factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. There are three scenic quality classes.

Class A areas are those that combine the most outstanding characteristics of each rating factor.

Class B areas are areas in which there is a combination of some outstanding features and some which are fairly common to the physiographic region.

Class C areas are those in which the features are fairly common to the physiographic region.

Management classes determine the amount of modification allowed to the basic elements of the landscape. There are five classes.

Class I: Very limited management activity is allowed. Created contrasts must not attract attention. This classification applies to wilderness areas, wild and scenic rivers, etc.

Class II: Changes in any of the basic elements caused by management activity should not be evident in the characteristic landscape. Contrasts are seen but must not attract attention.

Class III: Contrasts to the basic elements caused by a management activity are evident but should remain subordinate to the existing landscape.

Class IV: Any contrast attracts attention and is a dominant feature of the landscape in terms of scale, but it should repeat the form, line, color, and texture of the characteristic landscape.

CLass V: The Class V classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to one of the four other classifications. The classification also applies to areas where there is potential to increase the landscape's visual quality. It is often used as an interim classification until objectives of another class can be reached.

APPENDIX E: AIR QUALITY

AIR QUALITY LAWS

Federal law for the control of air pollution has been evolving for more than a decade. Congress passed the Air Quality Act, the first clean air legislation, in 1967. This was followed by the Clean Air Acts of 1970 and 1977, in which Congress reaffirmed its determination to cope with the growing national problem of air pollution.

The EPA, which has the major federal role in ensuring compliance with the requirements of the Clean Air Acts, issues national air quality regulations, approves and oversees state implementation plans, and conducts major enforcement programs.

State air pollution control agencies have the primary responsibility for carrying out the acts on non-Indian lands through the development and execution of an acceptable state implementation plan, which must provide for the attainment and maintenance of air quality standards within the state. The states of Wyoming and Montana both have EPA-approved state implementation plans.

The EPA has jurisdiction over the air quality of Indian lands, since it has not been given the authority to delegate that responsibility to the states or the tribes.

To enforce the NAAQS requirements described in chapter 3, every part of the country has been classified as one of the following: (1) an "attainment" area, where air quality levels are better than the NAAQS limits; (2) a "nonattainable" area, where pollution levels in the air exceed the NAAQS limits; or (3) an "unclassified" area, where there is insufficient data for classification. Nonattainment areas, typically urban, are subject to regulatory requirements designed to bring area pollution levels down to the NAAQS ceiling.

The PSD program, which is designed to protect air quality from significant deterioration in areas that meet the NAAQS, allows specific increments above existing pollution levels. PSD requirements are enforced by a complex preconstruction permit system for major new stationary pollution sources and for major modification to existing sources. The PSD permit process involves the study of existing air quality, requirements for the use of best available pollution control technology, and various impact studies to ensure that PSD standards (established thus far only for particulate matter and sulfur dioxide) will not be exceeded by allowing pollution sources to operate in the area.

If the PSD source is to be located near a Class I area, it may not exceed the PSD standards or have any adverse impact on the air quality-related values of the Class I area, including visibility. Visibility is protected both within the Class I area itself and with respect to "integral vistas" extending outside the Class I boundary.

If a proposed PSD source cannot satisfy the maxiumum allowable deterioration increments for a mandatory Class I area, it may have an opportunity to seek a waiver or a variance.

All pollutant sources must be evaluated to determine PSD applicability. Coal mines are subject to a new source review of PSD only if nonfugitive emissions of any regulated pollutant exceed 250 tons per year after application of controls. Surface coal mines will seldom have the potential to exceed that level. This essentially eliminates the proposed lease tracts from the detailed PSD review process. However, end-use facilities such as coal-fired power plants like the proposed Mud Springs power plant are subject to PSD review and "new source" performance standards.

Air pollution also may result in significant visibility reductions. The effects of such reductions include not only the aesthetic degradation of the environment but also economic burdens on society.

METHODOLOGY USED IN ANALYSIS

Advanced computer modeling was used to evaluate the cumulative regional effects of ground-level concentrations of major air contaminants that could be expected under each alternative. The modeling study included determination of worst-case ground-level concentrations of the major air pollutants named above and sulfates, a secondary pollutant deriving from sulfur dioxide.

The resulting projections of pollutant concentrations were compared with state and federal air quality standards to determine the extent to which the standards could potentially be violated under each alternative. Incremental pollutant concentrations also were compared with increments allowable under the regulations for prevention of significant deterioration of air quality to determine the extent to which those regulations could be violated. The effects of air pollutants on visibility also were modeled.

A technical report prepared by PEDCo Environmental, Inc., discusses the models, meteorological data, receptor array, and vistas used in the analysis. It also describes characterization of the source of emission, including emission factors, control devices, and effeciencies. Also included are the major point sources and are sources that would be affected by mines and end-use facilities included in the alternatives.

KEY TO MINES SHOWN ON AIR QUALITY FIGURES

$\boxed{1}$ = BLM Tract Included in Alternatives

1. Ridgerunner
2. Porcupine
3. Thundercloud
4. Kintz Creek
5. Mount Logan
6. Timber Creek
7. Donkey Creek
8. Hay Creek
9. Calf Creek
10. Hidden Water
11. Youngs Creek
12. Wolf Mountain Maintenance
13. North Decker II
14. North Decker I
15. Spring Creek
16. Northwest Otter Creek
17. Ashland (Decker-Birney)
18. Downee Coulee
19. Colstrip Maintenance
20. Colstrip C
21. Hanging Woman Creek
22. Mud Springs

① = Existing or Committed Operation

1. Antelope
2. North Antelope
3. North Rochelle
4. Black Thunder
5. Jacobs Ranch
6. Keeline
7. WYMO Fuels
8. Coal Creek
9. Cordero
10. Caballo Rojo
11. Pronghorn
12. Belle Ayr
13. Caballo
14. Rocky Butte
15. Wyodak
16. East Gillette
17. East Gillette No. 16
18. South Rawhide
19. Fort Union
20. Dry Fork
21. Eagle Butte
22. ETSI
23. North Rawhide
24. Buckskin
25. Big Horn
26. Ash Creek
27. East Decker
28. West Decker
29. North Decker
30. Spring Creek
31. Coal Creek
32. Big Sky
33. Colstrip A and B
34. Colstrip D

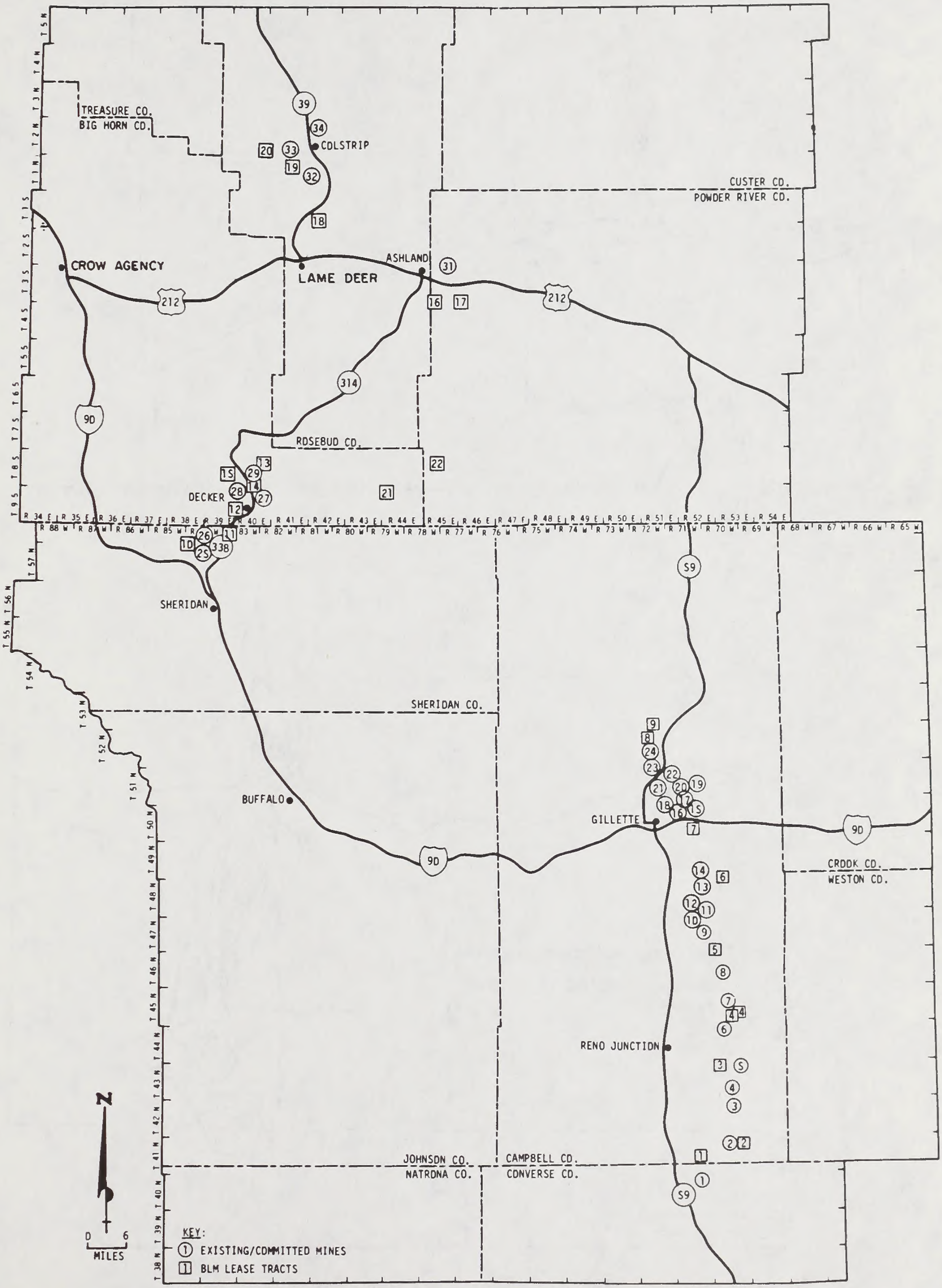


Figure 1. Regional Study Area

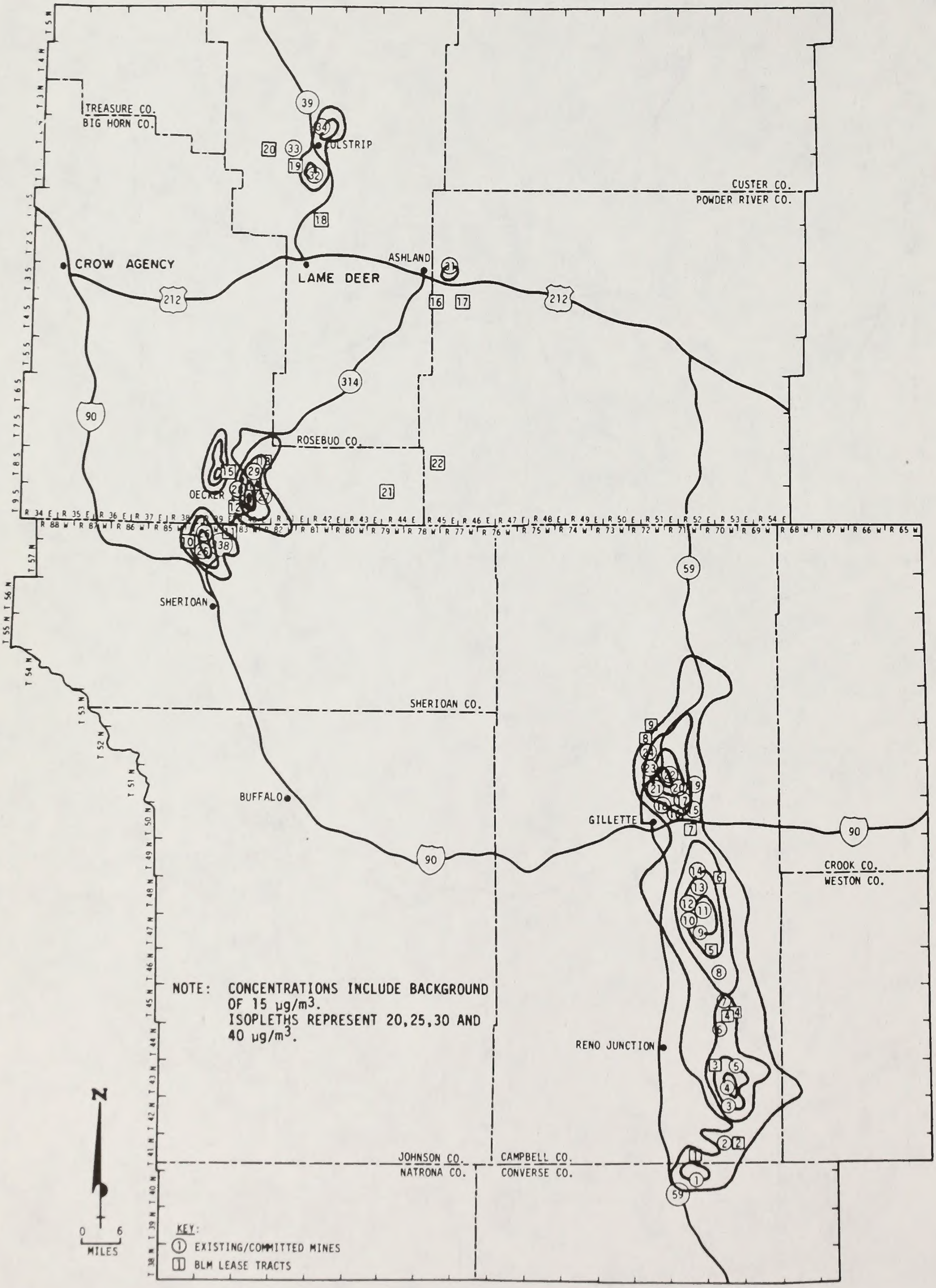


Figure 2. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 1.

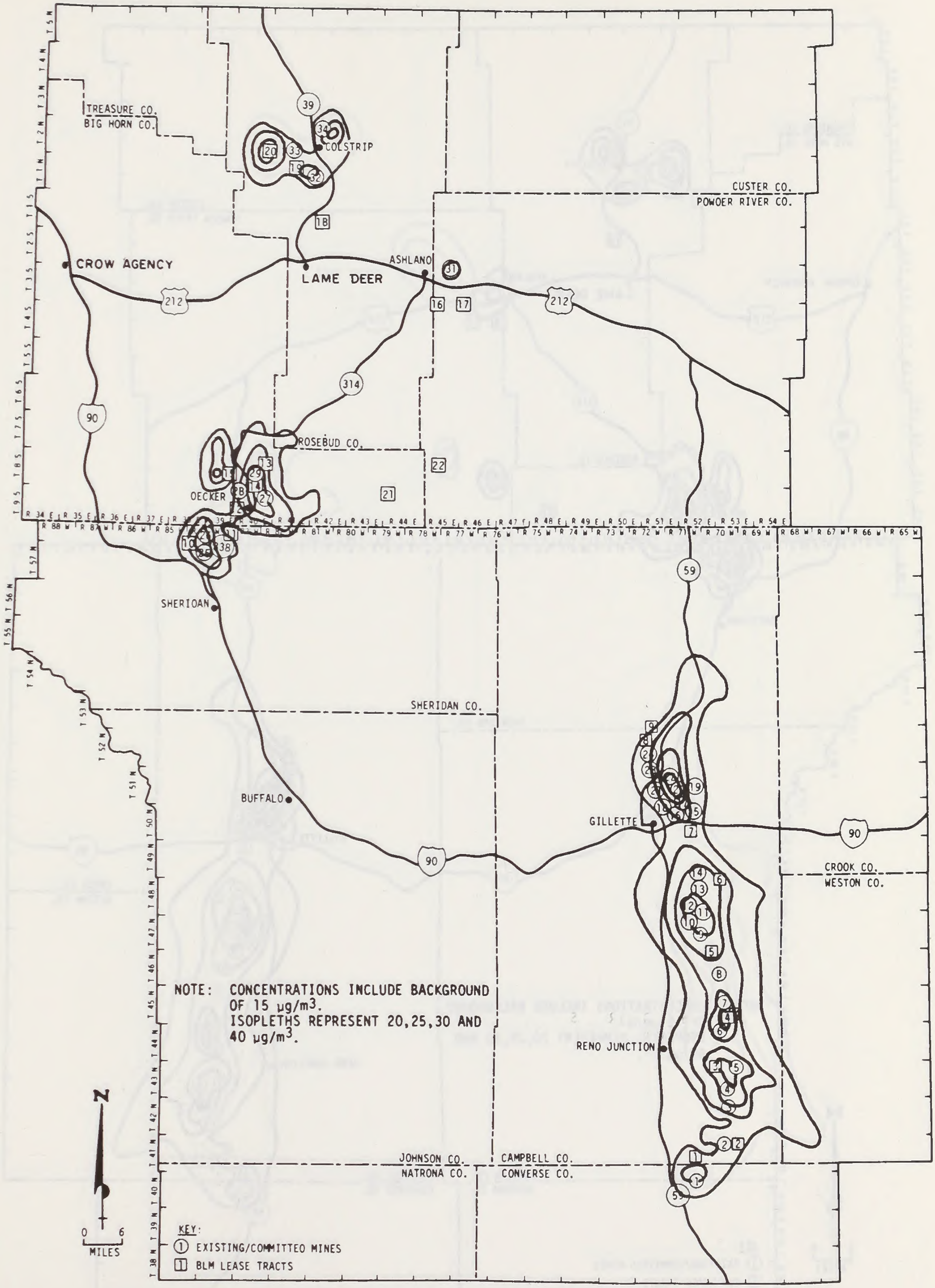


Figure 3. 1995 annual TSP concentrations (μg/m^3), Alternative 2.

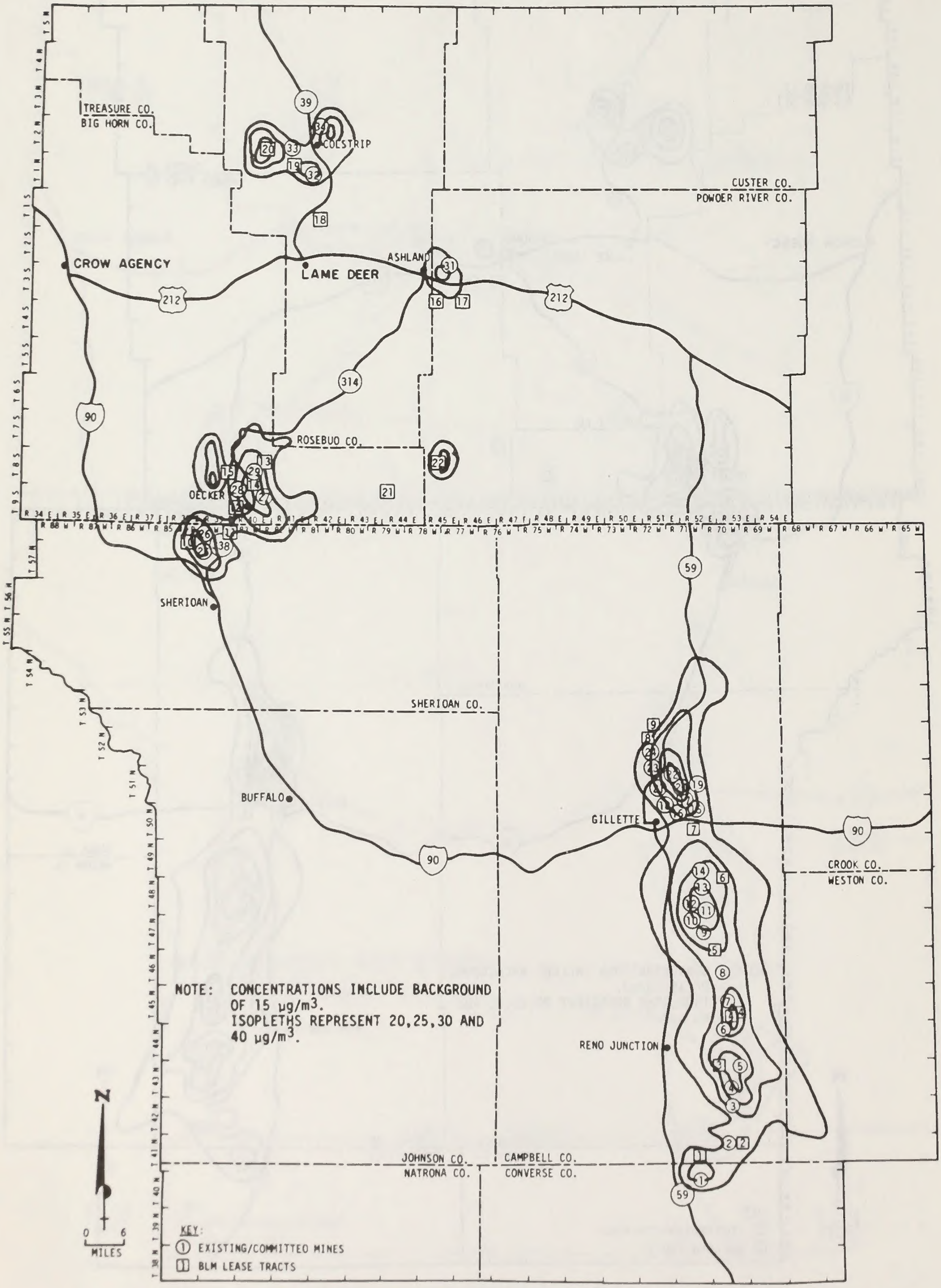
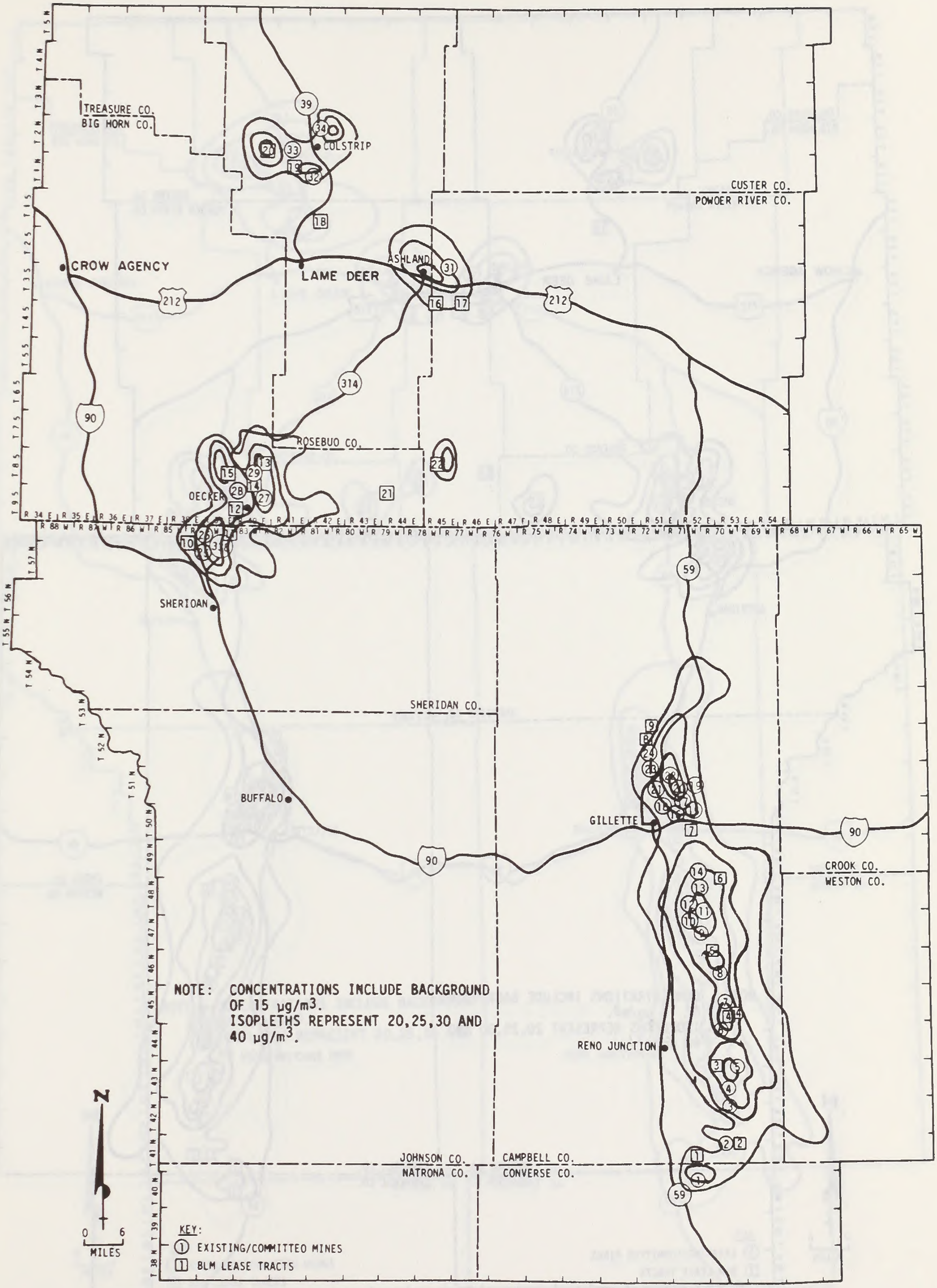
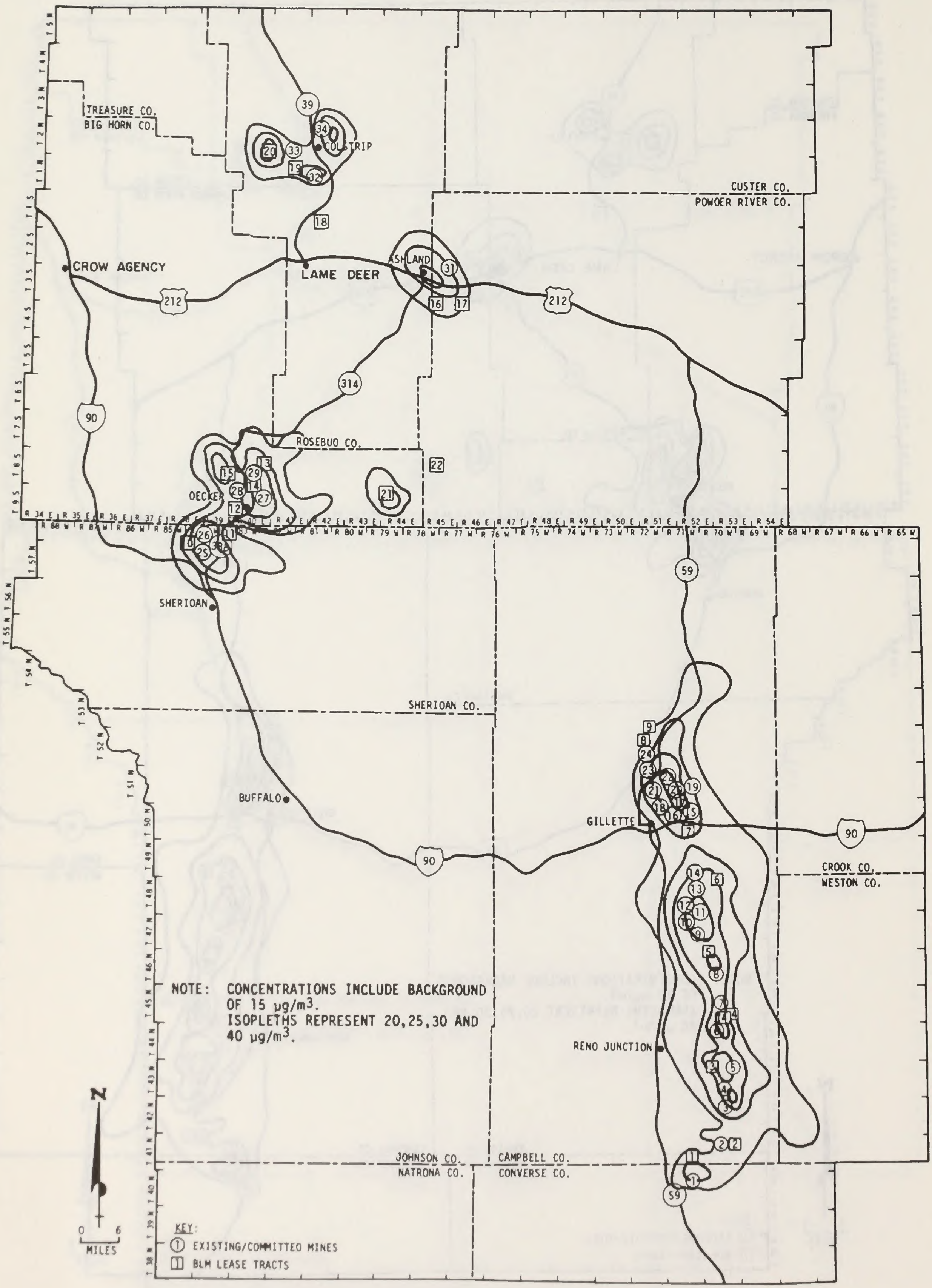


Figure 4. 1995 annual TSP concentrations (μg/m^3), Alternative 3.



NOTE: CONCENTRATIONS INCLUDE BACKGROUND OF 15 µg/m³. ISOPLETHS REPRESENT 20,25,30 AND 40 µg/m³.

Figure 5. 1995 annual TSP concentrations (µg/m³), Alternative 4.



NOTE: CONCENTRATIONS INCLUDE BACKGROUND OF 15 $\mu g/m^3$.
ISOPLETHS REPRESENT 20, 25, 30 AND 40 $\mu g/m^3$.

Figure 6. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 5.

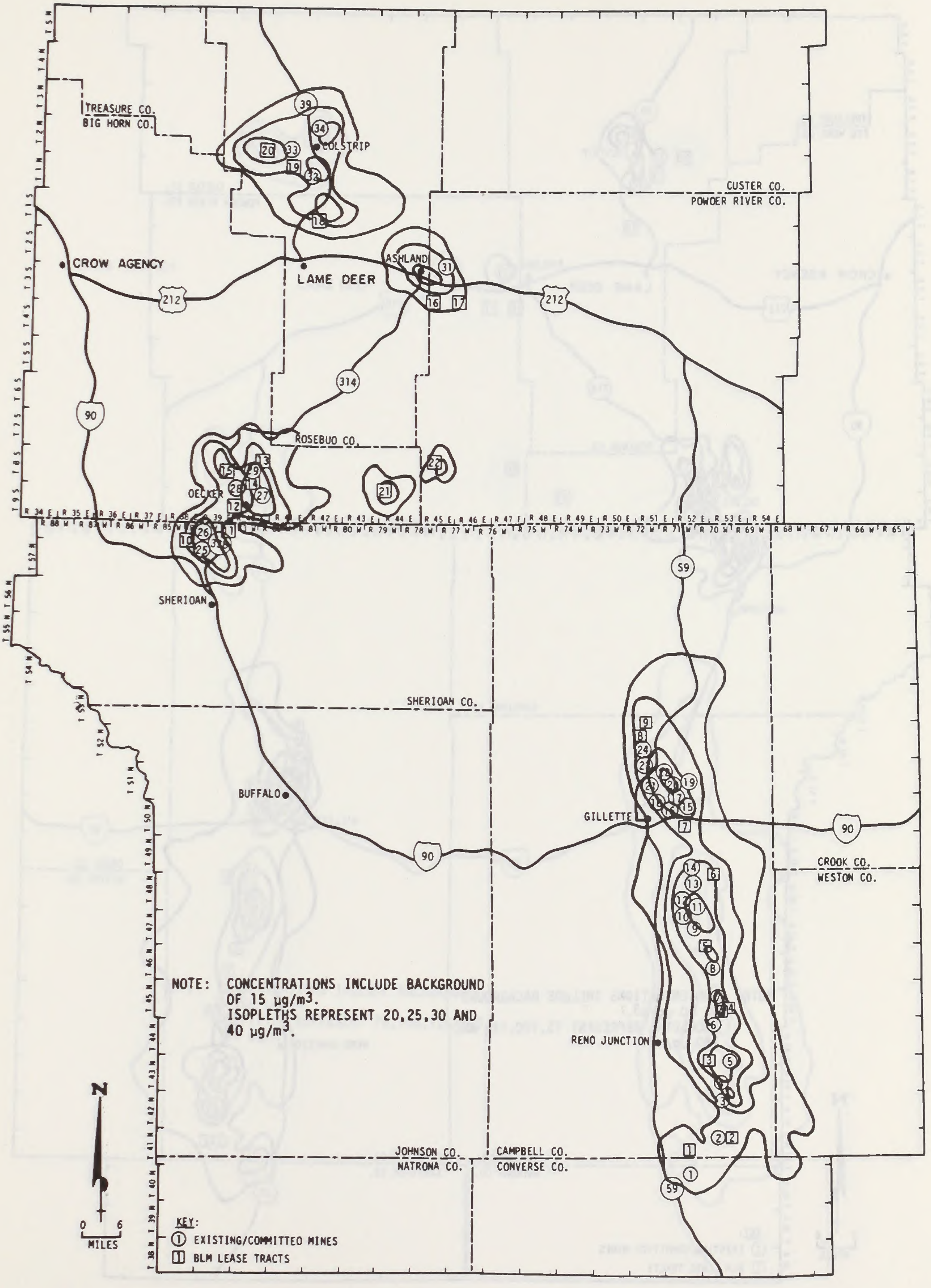


Figure 7. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 6.

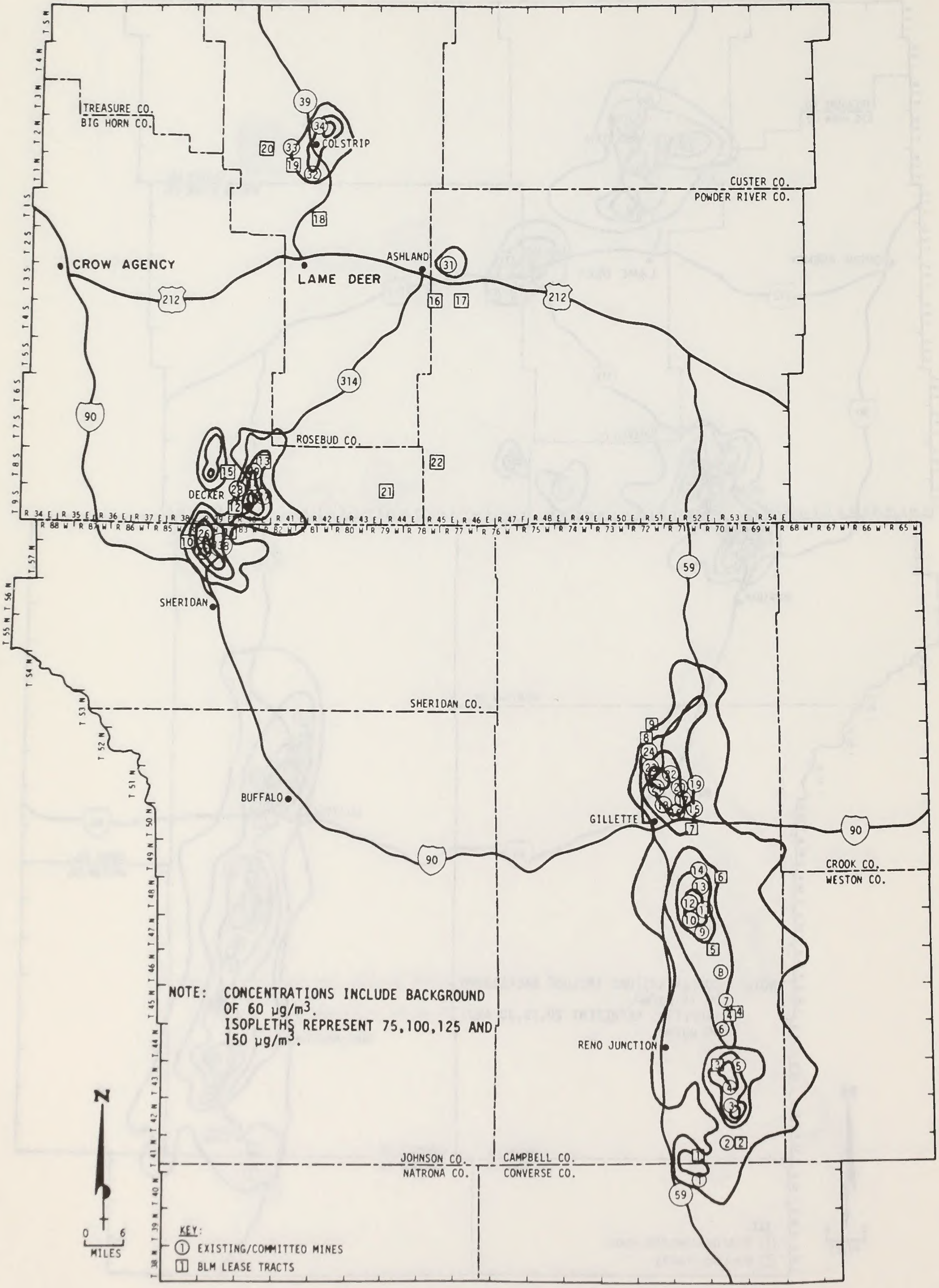


Figure 8. 1995 second-maximum 24-hour TSP concentrations (μg/m3), Alternative 1.

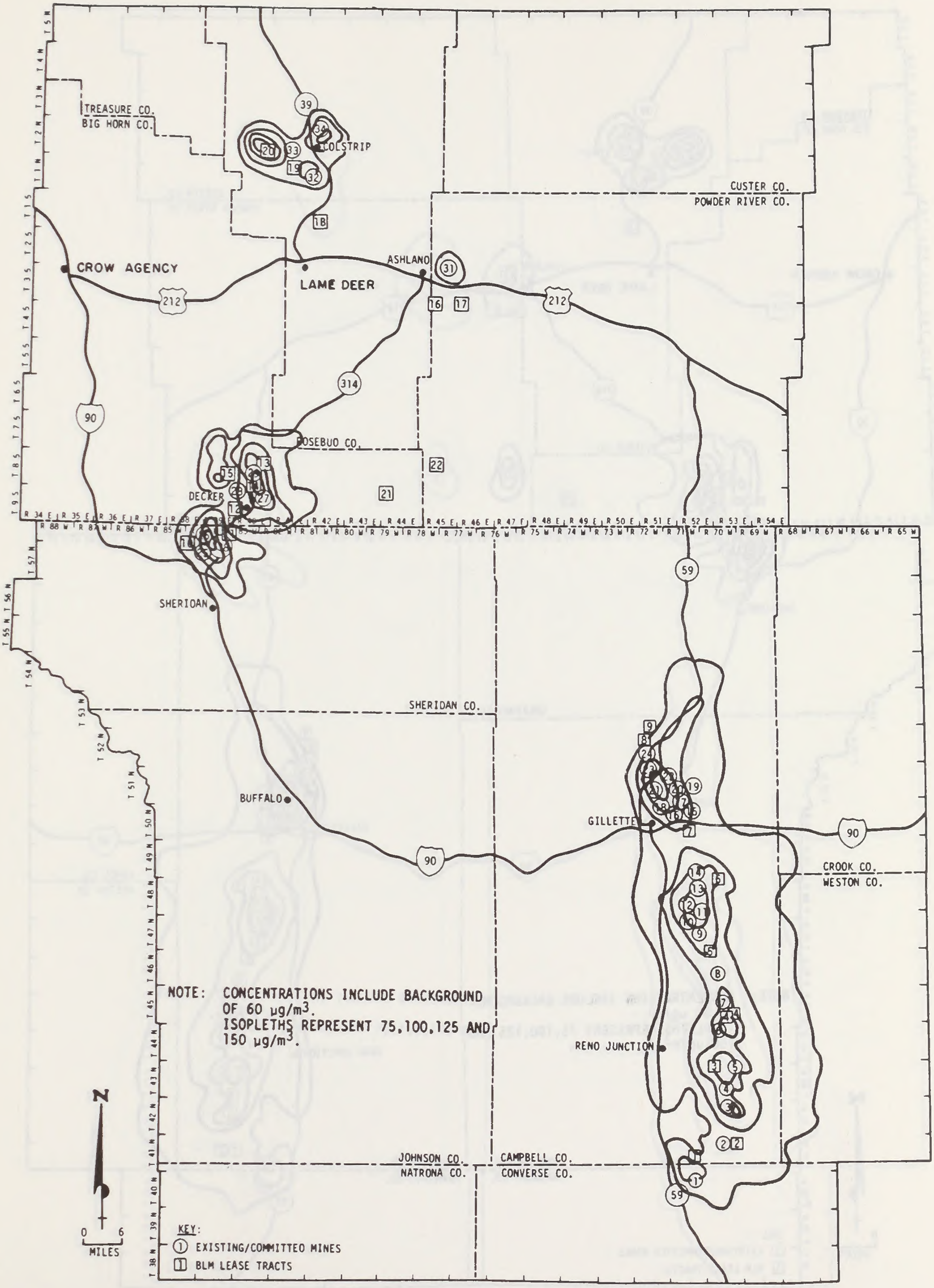


Figure 9. 1995 second-maximum 24-hour TSP concentrations (µg/m^3), Alternative 2.

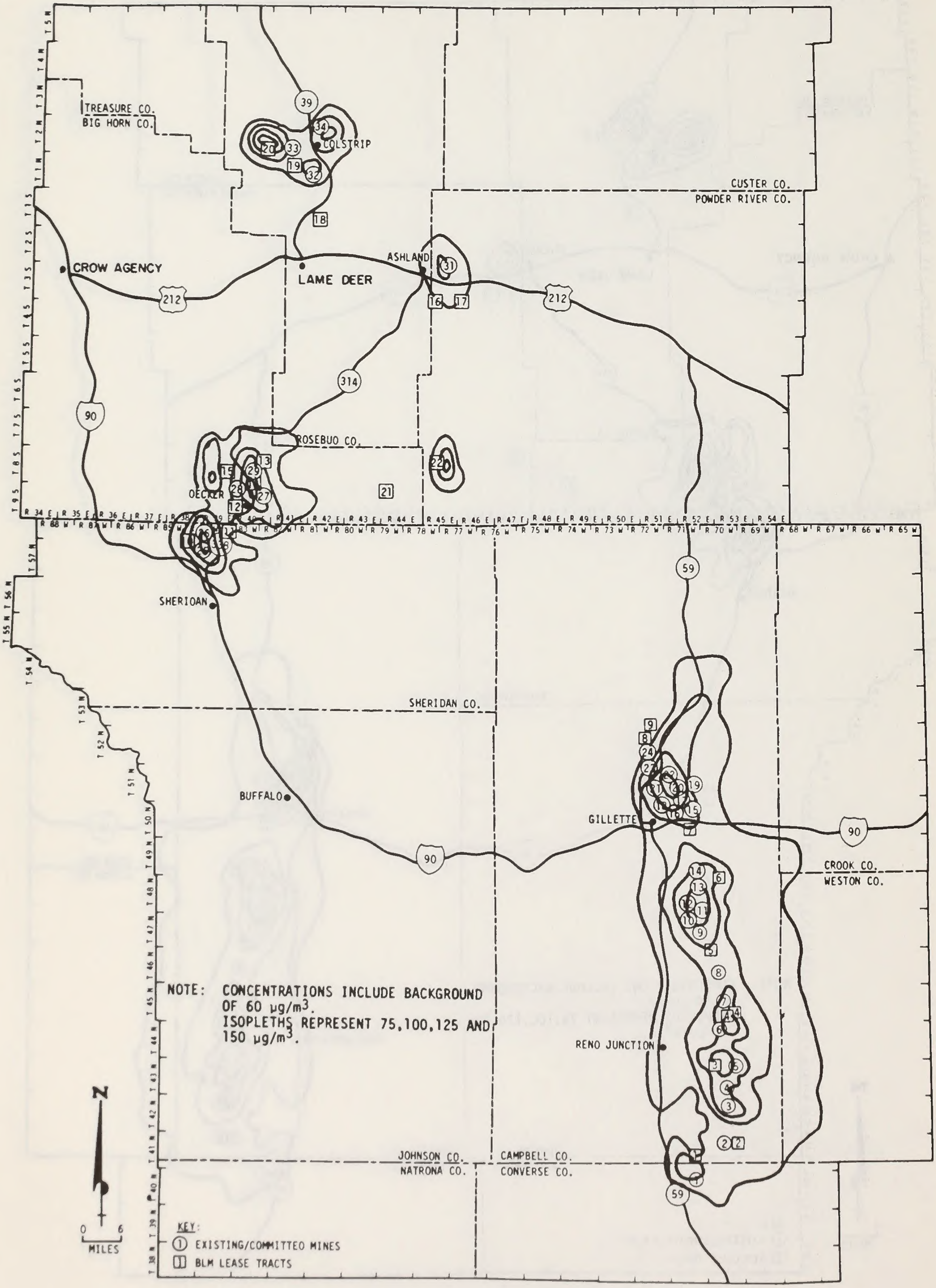
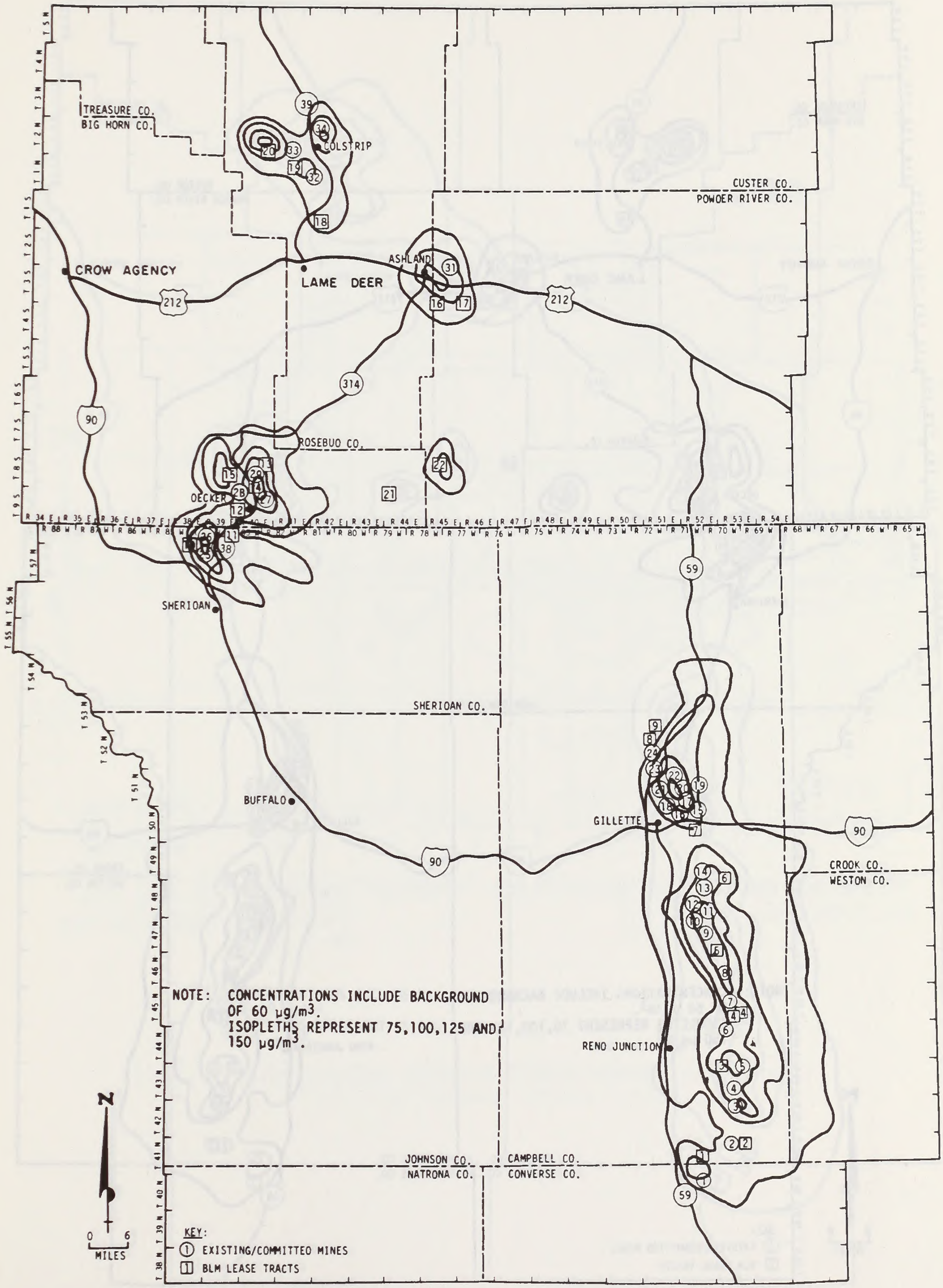


Figure 10. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 3.



NOTE: CONCENTRATIONS INCLUDE BACKGROUND OF 60 μg/m³. ISOPLETHS REPRESENT 75,100,125 AND 150 μg/m³.

KEY:
① EXISTING/COMMITTED MINES
▢ BLM LEASE TRACTS

Figure 11. 1995 second-maximum 24-hour TSP concentrations (μg/m³), Alternative 4.

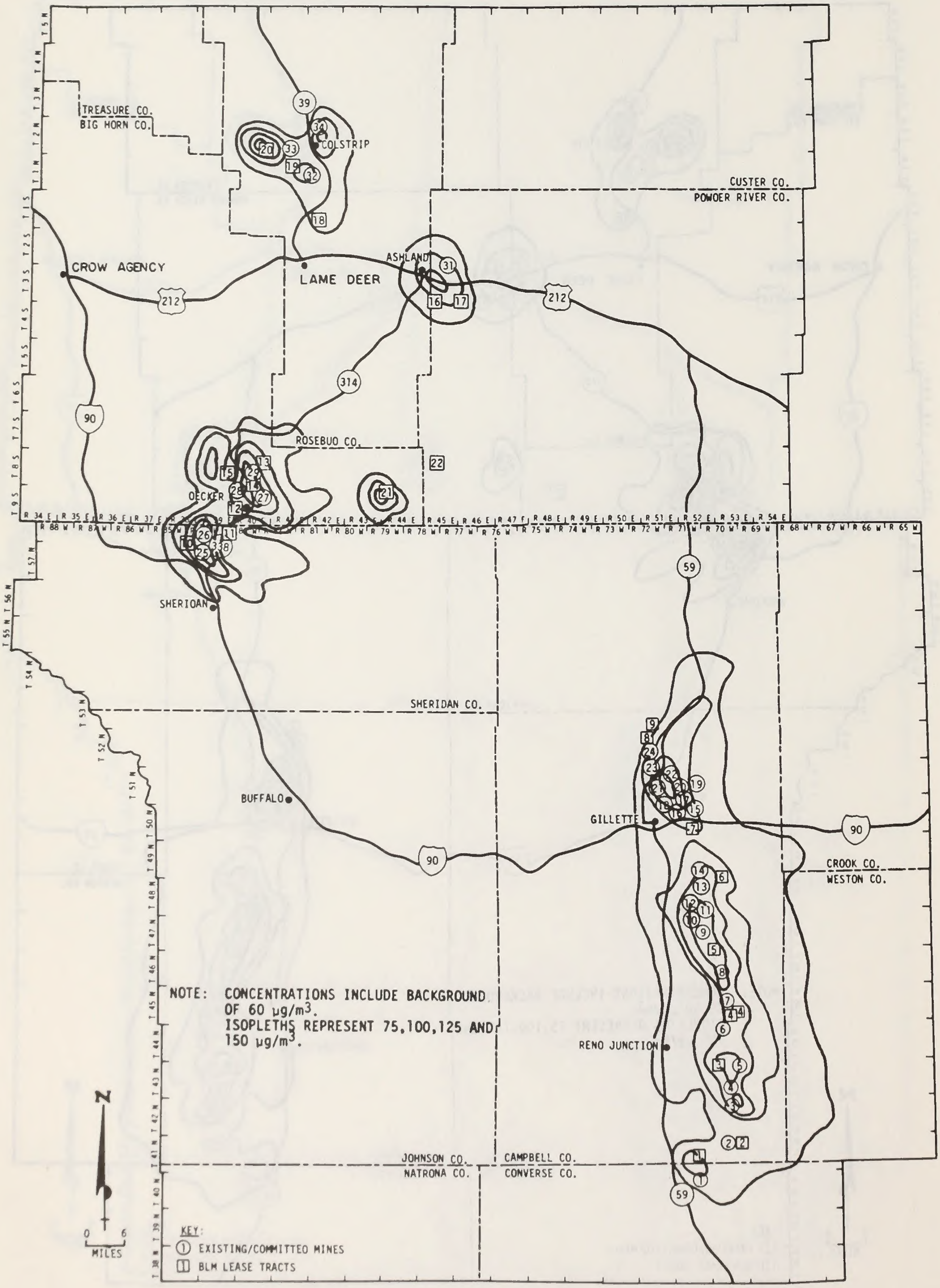
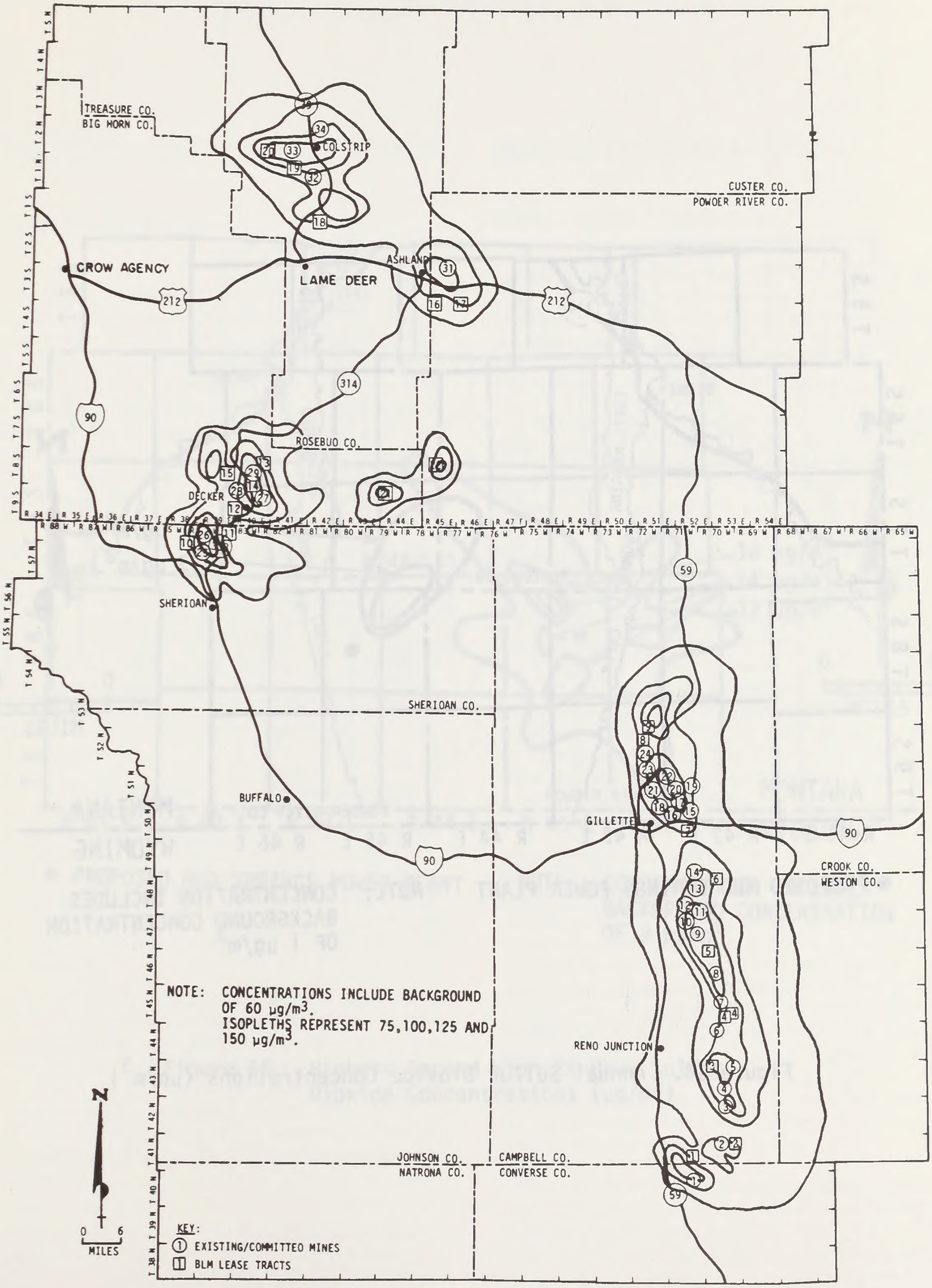
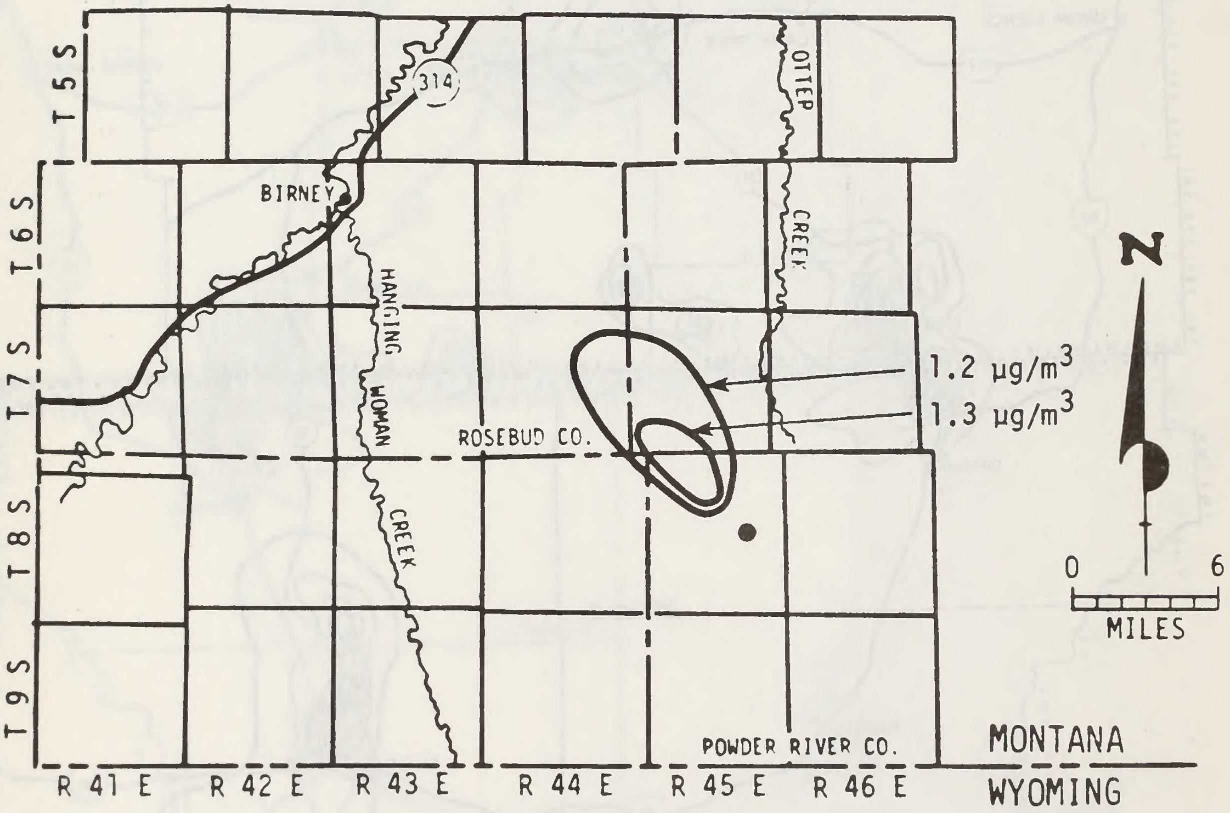


Figure 12. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 5.



NOTE: CONCENTRATIONS INCLUDE BACKGROUND OF 60 μg/m3.
ISOPLETHS REPRESENT 75,100,125 AND 150 μg/m3.

Figure 13. 1995 second-maximum 24-hour TSP concentrations (μg/m^3), Alternative 6.



● PROPOSED MUD SPRINGS POWER PLANT

NOTE: CONCENTRATION INCLUDES BACKGROUND CONCENTRATION OF 1 $\mu g/m^3$

Figure 14. Annual Sulfur Dioxide Concentrations ($\mu g/m^3$)

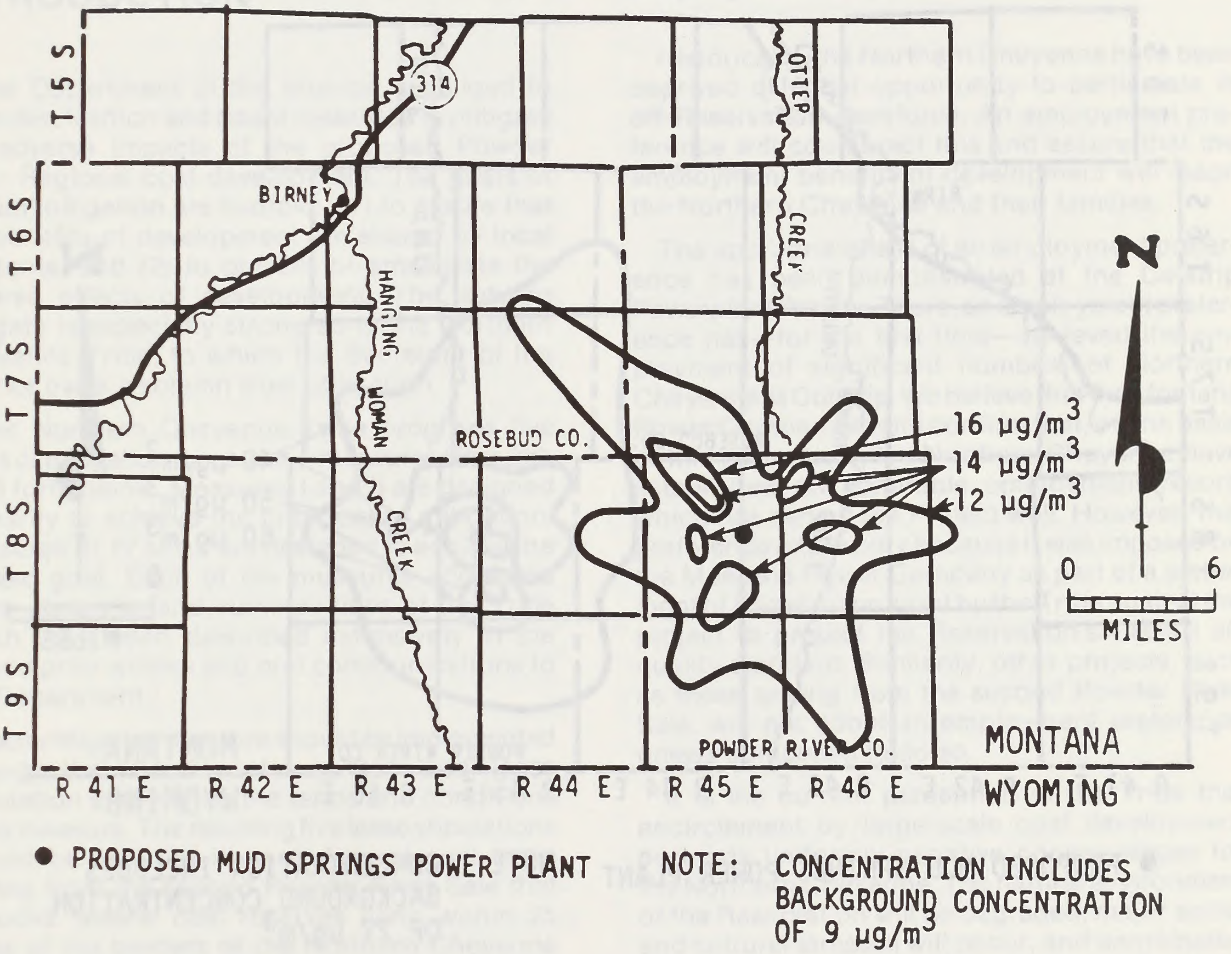
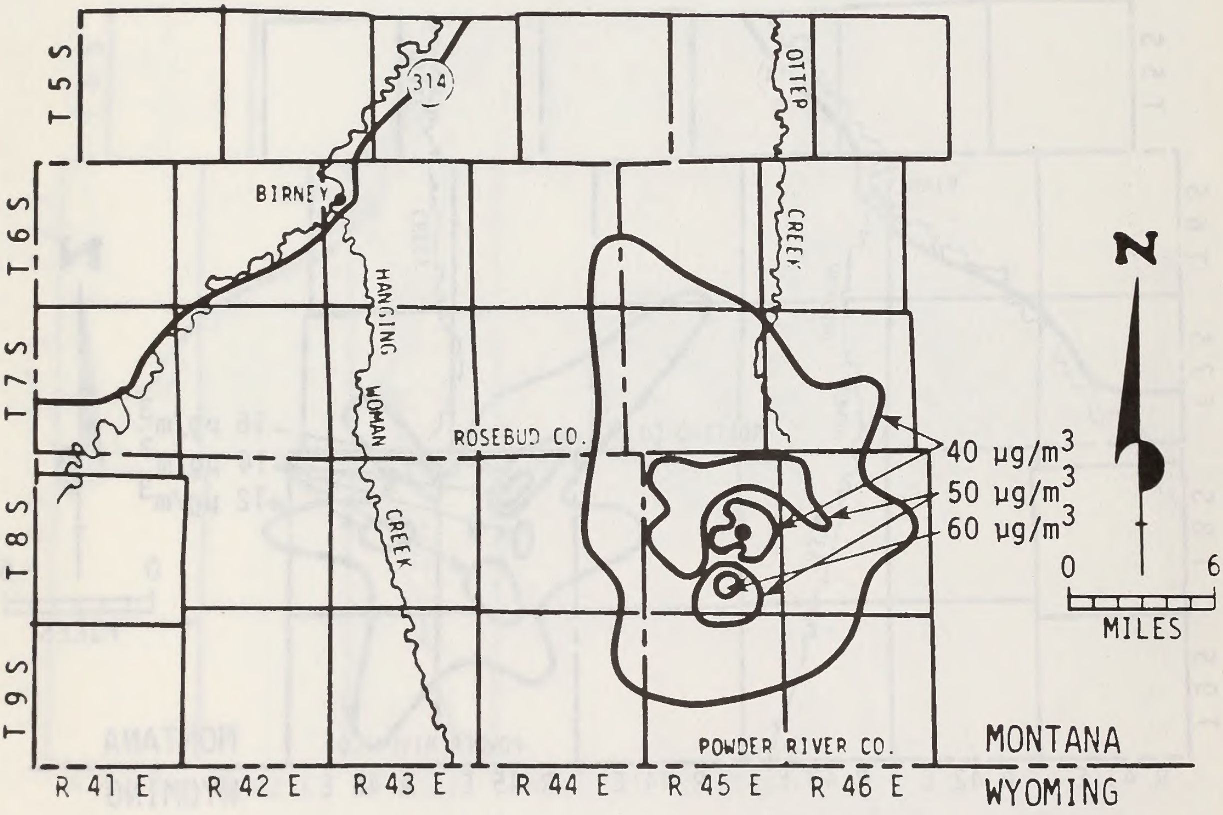


Figure 15. Highest Second High 24-Hour Sulfur Dioxide Concentrations (µg/m^3)



● PROPOSED MUD SPRINGS POWER PLANT

NOTE: CONCENTRATION INCLUDES BACKGROUND CONCENTRATION OF 27 $\mu g/m^3$

Figure 16. Highest Second High 3-Hour Sulfur Dioxide Concentrations ($\mu g/m^3$)

APPENDIX F: NORTHERN CHEYENNE TRIBE'S PROPOSED STIPULATIONS

[Note: The following is the text of the report submitted to the BLM by the Northern Cheyenne Tribe.]

INTRODUCTION

The Department of the Interior is obliged to consider, fashion and adopt measures to mitigate the adverse impacts of the proposed Powder River Regional coal development. The goals of impact mitigation are twofold: (1) to assure that the benefits of development are shared by local residents, and (2) to prevent or ameliorate the adverse effects of development. The duty to mitigate is especially strong as to the Northern Cheyenne Tribe, to which the Secretary of the Interior owes a solemn trust obligation.

The Northern Cheyenne Tribe proposes five types of mitigation measures—measures I through V set forth below. Measures I and II are designed primarily to achieve the first goal of mitigation. Measures III, IV and V are designed to achieve the second goal. Each of the measures addresses major concerns and vulnerabilities of the Tribe which have been described extensively in the Tribe's prior written and oral communications to the Department.[1]

Each mitigation measure should be implemented through the adoption of a suitable coal lease stipulation embodying the terms and conditions of the measure. The resulting five lease stipulations should be inserted in each federal coal lease arising from the second Powder River Sale that includes federal coal reserves lying within 25 miles of the borders of the Northern Cheyenne Reservation.

Each mitigation measure contemplates some form of financial assistance to the Tribe. Although, as set forth below, these measures place the burden of providing such assistance on the lessees, the Tribe is, in fact, indifferent as to the source of such assistance. Other sources of financial assistance, including existing sources of federal funds administered by the Department, should be considered.

MITIGATION MEASURE I

Employment Preference

Historically, the Northern Cheyenne have been deprived of equal opportunity to participate in off-Reservation workforce. An employment preference will counteract this and assure that the employment benefits of development will reach the Northern Cheyenne and their families.

The appropriateness of an employment preference has been demonstrated at the Colstrip Powerplant Project. There, an employment preference has—for the first time—achieved the employment of significant numbers of Northern Cheyenne at Colstrip. We believe that the Montana Power Company would confirm that, on the basis of this preference, the Northern Cheyenne have established an admirable employment record which has served the Project well. However, this preference exists only because it was imposed on the Montana Power Company as part of a settlement of litigation brought by the Tribe against the project to protect the Reservation's Class I air quality standard. Similarly, other projects, such as those arising from the second Powder River Sale, will not adopt an employment preference unless compelled to do so.

It is the current perception of the Tribe that encirclement by large-scale coal development portends uniformly negative consequences for the Northern Cheyenne. The natural environment of the Reservation will be degraded, major social and cultural stresses will occur, and unmitigated financial burdens will be visited on a tribal government which presently is unable to provide adequate public services and facilities. Therefore, adopting an employment preference will endow the planned development with one positive attribute insofar as the Northern Cheyenne are concerned. This will serve federal regional coal development policy by generating significant grass roots support among the Northern Cheyenne.

The standard of living on the Northern Cheyenne Reservation is substantially lower than that which prevails off-Reservation. In light of his trust responsibility to the Tribe, the Secretary would be acting appropriately in ameliorating the harsh economic conditions prevailing on the Reservation by providing to the Northern Cheyenne the advantage of an employment preference.

---

[1] These consist of written and oral Tribal statements made during the formulation of the first Powder River Sale, in the Tribe's lawsuit against that Sale, at the three Regional Coal Team meetings held subsequent to the Sale, at the Ashland, Montana scoping meeting for the second Powder River Sale, and in subsequent communications to BLM.

Industry should prefer the development of an indigenous workforce: relocation costs are avoided, stability is enhanced, and much local goodwill is created. Also, to the extent that labor force is drawn from the local community, socio-economic impacts resulting from the in-migration of workforce will be decreased. We belive that the validity of these observations has been demonstrated in the employment preference program adopted at Colstrip.

Proposed Lease Stipulation

On the basis of the foregoing considerations, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Members of the Northern Cheyenne Tribe, their children and their spouses ["Preferred Employees"], shall be given preferential consideration in recruitment, training, hiring, promotion, and reductions in workforce, in all categories of employment.
2. The employment preference shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

    a. Quantitative goals, and a timetable for their achievement, for the employment of Preferred Employees in each job classification.

    b. Preservation of the lessee's authority to establish reasonable, even-handed and job-validated training programs, employment criteria, and work rules for all employees including Preferred Employees.

    c. Special programs for the recruitment of Preferred Employees.

    d. Special programs for the training of Preferred Employees, including on-the-job training, and training for advancement into supervisory positions.

    e. Special scholarships and tuition reimbursement programs for Preferred Employees.

    f. Special workshops for other project workforce to develop an awareness of Northern Cheyenne culture and concerns and an understanding of the need for and requirements of the employment preference.

    g. Special programs for the mass transportation of Preferred Employees between their homes and the job site.

    h. Notification to all involved labor unions of the existence of the employment preference and of the lessee's duty and intent to abide by its terms.

    i. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of the employment preference in connection with their own project employment practices.

    j. The establishment of an Employment Preference Committee, consisting of an equal number of representatives from the Tribe and the lessee, which shall supervise, monitor, and assure compliance with the terms of the employment preference.

    k. Funding provided by the lessee to pay reasonable compensation and expenses of the Tribe's representatives on the Employment Preference Committee and of such staff and advisors as the Tribal representatives reasonably consider necessary to the performance of their responsibilities.

MITIGATION MEASURE II

Contracting and Procurement Preference

Indian entrepreneurship on the Northern Cheyenne Reservation has largely been unsuccessful. Indian entrepreneurship off the Reservation is virtually nil. There are approximately 25 businesses on the Reservation, and approximately 30 businesses in off-Reservation Ashland and Birney. About half of the Reservation businesses, including the general store in Lame Deer, are owned by non-Indians. All of the off-Reservation businesses are owned by non-Indians. Although there are several construction service firms on the Reservation owned by Northern Cheyennes, only one has achieved success in obtaining off-Reservation contracts.

There are a number of reasons for this poor record. As with off-Reservation employment opportunity, historically the Northern Cheyenne have been excluded from an equal opportunity to participate in non-Indian sponsored commercial ventures. In addition, both the Tribe and Tribal members are unable to pledge their trust property as security for the acquisition of capital. Furthermore, with a scant record of previous commercial success, lenders are reluctant to fund Northern Cheyenne entrepreneurs.

Therefore, absent special measures, the Northern Cheyenne will not participate in the entrepreneurial benefits engendered by the planned regional development.

In his Indian Policy Statement of January 24, 1983, President Reagan recognized the need for promoting Indian entrepreneurship and the many institutional barriers to that goal. He acknowledged that a "flexible approach" was needed for "creating a more favorable environment for the development of healthy reservation economies." The Northern Cheyenne propose that in formulating the second Powder River Regional sale, the Secretary implement this policy by adopting special mitigation measures to promote Northern Cheyenne participation in the entrepreneurial opportunity engendered by the resulting development.

Proposed Lease Stipulation

To provide the Northern Cheyenne with access to the commercial opportunities that will result from regional development, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Businesses controlled by the Northern Cheyenne Tribe or its members ["Preferred Businesses"] shall be given preferential consideration in the awarding of all contracts and subcontracts (a) for the conduct of operations, and (b) for the procurement of materiel and equipment for operations.

2. These preferences shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

a. Quantitative goals, and a timetable for their achievement, for the awarding of contracts, subcontracts and procurement contracts to Preferred Businesses.

b. A certification procedure, under which a business entity applying for the status of Preferred Business may seek certification in the following two respects:

(1) as an entity actually controlled by the Tribe or a Tribal member; and

(2) as an entity capable of competently providing particular contract services or supplying particular materiel or equipment.

c. Technical and financial assistance to Preferred Businesses designed to assist them in obtaining such certification.

d. Advance notice to certified Preferred Businesses of service or procurement contracts to be awarded for which they are qualified.

e. Where services or procurement contracts are to be awarded by competitive bid, the establishment of formulas whereby a certified Preferred Business is granted a bidding margin, i.e., a reasonable sum by which its bid may exceed all other bids.

f. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of these preferences in connection with their own project contracting and procurement practices.

g. Establishment of a Contracting Preference Committee, consisting of an equal number of representatives from the Tribe and the lessee, which shall supervise, monitor, and assure compliance with the terms of the preference.

h. Funding provided by the lessee to pay reasonable compensation and expenses of the Tribe's representatives on the Contracting Preference Committee and of such staff and advisors as the Tribal representatives reasonably consider necessary to the performance of their responsibilities.

MITIGATION MEASURE III

Law and Order; Traffic

The Tribe previously has explained its profound concerns about the maintenance of the law and order of the Reservation. In recent years, regional development has led to increased use of the Reservation—its roads, recreation areas, services and facilities—by non-Indians as well as Indians. This has resulted in an increasing incidence of criminal and traffic violations that threaten the safety and tranquility of the Reservation. New leasing of federal coal reserves, bringing substantial population increases to the Reservation and the region as a whole, will multiply these problems. As the Tribe has explained, it is uniquely vulnerable to the resulting threats to law and order because of the anomalous jurisdictional status of non-Indians on the Reservation.

Proposed Lease Stipulation

To remedy this jurisdictional problem, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Each coal lessee shall obtain a covenant from each of its employees that while on the Reservation for any purpose the employee will comply with all standards of conduct generally applicable to Tribal members.
2. Each coal lessee shall obtain a covenant from each of its truckers that while operating trucks on the Reservation the trucker will comply with all laws, ordinances and rules applicable to the use of motor vehicles by Tribal members.
3. Each coal lesse shall by contract require (a) each of its contractors and subcontractors to obtain like covenanats from their employees and truckers, and (b) each of its suppliers to obtain a like covenant from their truckers.
4. The above described duties imposed on employees and truckers shall be enforced by each coal lessee, and its contractors, subcontractors and suppliers, by taking appropriate employee-related disciplinary action in the event a violation of such duties is reported by the Tribe.
5. These provisions shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

a. Assumption in writing, as a condition of employment, by each employee and trucker, of the conditions set forth in 1 through 4 above.

b. Education of employees and truckers with respect to the standards of conduct applicable on the Reservation.

c. Appropriate employee-related disciplinary action for particular violations.

d. Resolution of disputes concerning the occurence of violations.

e. Notification to all involved labor unions of the existence of the writen agreement and the lessee's duty and intent to abide by its terms.

f. Funding provided by the lessee to pay reasonable costs incurred by the Tribe in implementing the agreement.

MITIGATION MEASURE IV

Environmental Protection

The Northern Cheyenne Reservation serves as the traditional homeland of the Northern Cheyenne people. As the Department knows, the Tribe considers the preservation of the Reservation's physical environment to be of paramount importance. The Tribe has taken decisive action—in adopting a Class I air quality classification and opposing on-Reservation coal development—in pursuit of that goal. Unlike other lands to the north, east, and south, the Reservation is not a fungible piece of real estate. Its preservation is essential to the survival of the Tribe itself.

The major industrial development that will result from federal coal leasing poses a threat to air and water quality on the Reservation, the Reservation's plant and animal life, and the health and welfare of Tribal members. Because the Reservation occupies the geographic center of the planned development, it is especially vulnerable to adverse environmental impacts. Furthermore, since the Northern Cheyenne Reservation is the only possible homeland for the Northern Cheyenne people, adverse environmental impacts on the natural resources of the Reservation—which serve as the wellspring of the Northern Cheyenne culture—are of unique concern in the region. This concern is specially relevant to actions taken by the Secretary of the Interior, who has a solemn trust obligation to safeguard the Northern Cheyenne homeland. Thus, special steps should be taken to protect the environmental quality of the Reservation.

Proposed Lease Stipulation

In order to monitor and prevent degradation of the Reservation's natural environment, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. A program shall be established to monitor air quality, visibility, water quality, and biological and other resources on the Reservation which may be affected adversely by the project. The program shall provide for baseline monitoring for a reasonable period before construction of the project and ongoing monitoring thereafter throughout the life of the project.
2. The program shall be conducted under the terms of a written agreement among the Tribe, the coal lessee, and all federal and state agencies with pollution control jurisdiction over the project, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

    a. Comprehensive monitoring of Reservation sources as provided in 1 above.

    b. Utilization of state-of-the-art monitoring equipment and techniques, to be maintained in good operating condition and upgraded to reflect advances in technology.

    c. Use of qualified professional to design and conduct monitoring and analyze results.

    d. Recruitment, training (including technical education and on-the-job training), and employment of Tribal members, their children and their spouses ["Preferred Employees"] to assume responsibility to the fullest extent possible for the operation of the monitoring program.

    e. The establishment of an Environmental Monitoring Committee consisting of four representatives, one each from the Tribe, the lessee, the involved federal agencies, and the involved state agencies, which shall supervise and direct the monitoring program and assure that it is carried out according to the terms of the agreement.

    f. Remedies in the event that air or water quality standards applicable to the Reservation are violated or that Reservation resources are materially impaired as a result of the construction or operation of the project.

    g. Funding provided by the lessee to pay: (1) the costs of the monitoring program, including the acquisition, maintenance and upgrading of equipment, the salaries of program employees, and the recruitment and training of Preferred Employees; and (2) reasonable compensation and expenses of the Tribe's representative on the Environmental Monitoring Committee, and of such staff and advisors as the Tribal representative reasonably considers necessary to the performance of his responsibilities. When an environmental monitoring program established for a particular project will contribute to the environmental monitoring program required for one or more other projects, the programs shall be integrated to the fullest extent reasonably possible, and the capital and operating costs of the integrated program shall be equitably apportioned among the projects.

MITIGATION MEASURE V

Impact Assistance

The tribe has repeatedly advised the Department of its concerns regarding the increased demands that will be placed on Reservation public services and facilities as a result of regional coal development. The Reservation is in no sense immune from these demands; indeed, given its central location, it is uniquely vulnerable to them. However, as between the Tribe and its off-Reservation counterparts, there is a gross disparity in the availability of funds to satisfy these demands.

Off-Reservation, state and local governments can draw upon a variety of revenue sources in order to prepare for and meet the impacts of massive coal development. In addition to traditional sources of revenue, such as real and personal property taxes and the sale of tax exempt bonds, these units of government receive a significant portion of the income generated by coal mining. Fifty percent of the federal bonuses, rentals and royalties are returned to the state. In addition, 30% of mine income is collected by the state through its severence tax, and an additional percentage is collected by the counties through the coal gross proceeds tax.

These revenue sources are unavailable to the Tribe: it receives no part of the federal bonuses, rentals or royalties, it cannot collect severence, gross proceeds or any other taxes from the mines, and it has virtually no independent tax base of its own on which to draw. Although new federal legislation (which expires unless reenacted in 1984) permits Indian tribes to sell tax exempt bonds, and state law now permits tribes to apply for grants and loans from Montana's Coal Board, neither will serve as a reliable or adequate source of funding for the Tribe.

In short, off-Reservation governments receive substantial revenues as a result of development from which the Tribe is excluded. Such revenues provide off-Reservation communities with the means to mitigate negative consequences of development. Similar provision should be made for the Tribe.

Proposed Lease Stipulations

The Northern Cheyenne Tribe proposes two alternative lease stipulations as mitigation measures, either of which may enable it to mitigate adverse socioeconomic impacts on the Reservation:

Alternative A

The federal government returns 50% of coal lease bonuses, rentals and royalties to the state ["Off-Reservation Federal Impact Funds"]. By federal statute, these funds are to be used to mitigate adverse impacts of coal development. These impacts can be expected to occur in Big Horn, Rosebud and Powder River Counties [the "Three County Area"], both on and off the Reservation.

No portion of Off-Reservation Federal Impact Funds, however, is made available to the Tribe. The Tribe proposes that is be provided with a reasonably proportionate level of funding. It should be recognized that such funding will be substantially less than the total funding available to off-Reservation governments, since, as noted above, off-Reservation governments have other sources of funding that are not available to the Tribe.

Specifically, this proposed stipulation is as follows:

1. The lessee shall make contributions to the Tribe for the exclusive purpose of planning and providing public services and facilities on the Reservation.
2. Lessee contributions shall be calculated by taking the amount of Off-Reservation Federal Impact Funds generated by the lease, dividing by the non-Reservation resident population of the Three County Area, and then multiplying the resident population of the Northern Cheyenne Reservation.
3. Lessee contributions shall be provided to the Tribe at the same time that the Off-Reservation Federal Impact Funds are provided to the state.
4. This funding program will be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted therafter with diligence and good faith.

Alternative B

Through the existing taxation and impact funding regime, coal lessees will contribute substantial revenues to the increased costs of off-Reservation public services and facilities. However, they will make no significant contribution to such costs on the Reservation. Yet it is clear that development-induced increases in regional population, both on and off the Reservation, will place significant new demands on Reservation services and facilities.

If a coal project causes workforce and their families to reside on the Reservation, the project should bear some portion of the resulting costs incurred by the Tribe for Reservation services and facilities. The Tribe suggests that the Tribe and the project contribute equally to these increased costs. A per capita funding formula is suggested to achieve this.

Appendix F

In addition, project workforce and their families residing off-Reservation will burden Reservation services and facilities. Here, too, the project should bear some portion of these increased Tribal costs. The Tribe suggests that the project make a reduced contribution to these costs. This contribution will be based only on the number of workers, without including their families as well, and uses a per capita funding rate which is one-third of that applicable to on-Reservation residents.

This would be a most conservative measure of the impact costs to be incurred by the Tribe. First, it provides for cost sharing between the Tribe and the project. Second, the calculation is based only on Tribal expenditures from its own funds, ignoring contributions from other sources. Third, it includes only selected Tribal programs. Fourth, it will not provide to the Tribe the enormous funding which will be provided to the state and its subdivisions. In short, under this proposal a modest level of assistance will be provided to the Tribe to help it meet the service and facility demands engendered by development.

Specifically, this proposed stipulation is as follows:

1. The lessee shall make an annual contribution to the Tribe for the exclusive purpose of planning and providing public services and facilities on the Reservation.
2. Lessee contributions shall be based on the Tribe's own expenditures for Reservation services and facilities ["Tribal Expenditure"]. The Tribal Expenditure shall be calculated by determining the total amount of Tribal funds committed during the previous year to the Tribal programs listed below and dividing that sum by that year's total resident Reservation population. The programs to be included are:

   a. Education
   b. Ambulance service
   c. Health care
   d. Alcoholism and drug abuse treatment
   e. Law and order
   f. Tribal court
   g. Rural officers—game warden program
   h. Recreational facilities
   i. Transportation
   j. Shelter home for children
   k. Day care
   l. Elderly residence and care
   m. Garbage cannister program
   n. Utility commission
   o. Tribal government

3. The lessee shall contribute annually 100% of the Tribal Expenditure for each project employee, and for each member of the employee's household, who resides on the Reservation. In addition, the lessee shall contribute annually 33 1/3% of the Tribal Expenditure for each project employee who resides off the Reservation.
4. This mitigation program shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith.

REFERENCES

A NOTE ABOUT TRACT PROFILES

Reference is made to "the individual tract profiles." These are site-specific analyses prepared by the Bureau of Land Management or the Forest Service for each tract delineated for possible coal leasing. Copies of the following tract profiles are available upon request from the Casper District office, Bureau of Land Management.

BLM Tracts in Wyoming	Thunder Basin National Grassland Tracts in Wyoming	BLM Tracts in Montana
Youngs Creek	Thundercloud	Colstrip Maintenance
Hidden Water	Porcupine	Colstrip Area C
Calf Creek	Ridgerunner	Spring Creek
Hay Creek		North Decker I
Donkey Creek		North Decker II
Timber Creek		Wolf Mountain Maintenance
Mount Logan		Downey Coulee
Kintz Creek		Ashland (Decker-Birney)
		Northwest Otter Creek
		Hanging Woman Creek
		Mud Springs

SOURCES CITED

American Indian Technical Services

1983 "Socioeconomic Impact Assessment: Shell's Proposed Young's Creek Mine, Crow Indian Reservation, Montana." Report prepared for the Office of Surface Mining, Denver, and the Crow Tribe of Indians, Crow Agency, Montana. Broomfield, CO.

Braut, Art

1983 Personal communication with Darrel Schwilling of Casper District, BLM, on July 21, 1983, regarding pavement management program in Montana. Braut is with the Montana State Highway Department.

Briggs, Peter

1981 Personal communication with Darrel Schwilling of Casper District, BLM, regarding impacts of increased traffic on railroad company. Briggs is with Burlington Northern.

Browne, Bortz, and Coddington

1983 "The Campbell County Socioeconomic Monitoring Report." Denver.

Coenenberg, Joe

1982 "Methods for Establishment of Diverse Native Plant Communities at the Rosebud Mine." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

DePuit, Edward J.

1982 "Cool Season Perennial Grass Establishment on Northern Great Plains Mined Lands: Status of Current Technology." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Eddleman, Lee

1982 "Research on Shrub Establishment in Reclamation of Surface Mined Lands." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

References

Frison, George C.

1978 *Prehistoric Hunters of the High Plains.* New York: Academic Press.

Glass, Gary B.

1976 "Update on the Powder River Coal Basin." In *Wyoming Geological Association 28th Annual Field Conference Guidebook*, pp. 209-220. Edited by Richard Laudon. Casper, WY: Wyoming Geological Association.

1980 *Guide Book to the Coal Geology of the Powder River Coal Basin.* Publication 14. Cheyenne, WY: Wyoming Geological Survey.

Hanlin, Dave

1983 Personal communication with Darrel Schwilling of Casper District, BLM, on July 21, 1983, regarding planned highway work in Wyoming. Hanlin is with the Wyoming Highway Department.

Hasfurther, Victor R.; Akerbergs, Michael; and Shafer, Ralph G.

1982 "Hydrologic Impact of Surface Coal Mining in Northeastern Wyoming." In *Hydrology Symposium on Surface Coal Mines in Powder River Basin,* Gillette Area Groundwater Monitoring Organization. Gillette, WY.

Hooper, Douglas, and Branch, Kristi

1982 "Community Research Working Paper: Forsyth, Montana." (BLM social effects project.) Billings, MT: Mountain West Research.

Hooper, Douglas, and Jobes, Patrick

1982 "Community Research Working Paper: Ashland, Montana." (BLM social effects project.) Billings, MT: Mountain West Research.

Koch, Donald; Ringrose, Charles D.; Moore, Richard C.; and Brooks, David L.

1982 "Monitoring and Modeling of Shallow Ground Water Systems in the Powder River Basin." Prepared by Hittman Associates, Inc., for the Bureau of Mines, U.S. Department of the Interior, under contract J0265050.

Kroll, Cynthia

1983 "Social and Economic Impacts of Coal Leasing on the Northern Cheyenne Tribe: Methodology and Concerns." Report prepared for the Northern Cheyenne Tribe of Montana. Berkeley, CA.

McGowan, Ann

1983 Personal communication with Paul Myers of Denver Service Center, BLM, regarding divorce and school dropout statistics for Wyoming. McGowan is with the Wyoming Department of Economic Planning and Development.

Martin, Peter R.

1980 "Terrestrial Wildlife Habitat Inventory in Southeastern Montana." Report prepared by Montana Department of Fish, Wildlife, and Parks, which conducted research under the sponsorship of the Bureau of Land Management, U.S. Department of the Interior.

Matson, R. E., and Pinchock, John M.

1977 *Geology of the Tongue River Member, Fort Union Formation, Eastern Montana.*

Metcalf-Zier Archeologists, Inc.

1981 "A Class II Cultural Resources Inventory of the Eastern Powder River Basin, Wyoming," edited by T. C. Peebles. Report prepared for the BLM Wyoming State Office, Cheyenne. Eagle, CO.

Montana. Board of Crime Control

1981 *Annual Report.* Helena, MT.

Montana. Bureau of Mines and Geology

1973 *Quality and Reserves of Strippable Coal, Selected Deposits: Southeastern Montana,* by R. E. Matson and J. W. Blumers. Bulletin 91. Butte, MT.

1980 *Montana Coal: A Guide to Coal Geology, Resources, and Production,* by G. A. Cole, R. E. Matson, and R. T. Pederson. State Publication 83. Butte, MT.

Montana. Department of State Lands.

1982a *Draft EIS: Montco Mine, Rosebud County, Montana.* Helena, MT.

1982b *Draft EIS: Western Energy Company's Rosebud Mine, Area C, Block 1.* Helena, MT.

Montana. Department of State Lands and U.S. Office of Surface Mining.

1983 *Draft Environmental Impact Statement: Western Energy Company's Rosebud Mine.* No. OSM 83-120. N.p.

Montana Crop and Livestock Reporting Service

1980 *Montana Agricultural Statistics,* vol. 18. Helena, MT: Montana Crop and Livestock Reporting Service. Issued cooperatively by Montana Department of Agriculture and the Economics, Statistics, and Cooperative Service, U.S. Department of Agriculture.

Moore, James R.

1983 "Land Value Effects of the Proposed Decker Area Mines." Report prepared for Montana Department of State Lands and Office of Surface Mining, U.S. Department of the Interior. Billings, MT: Mountain West Research North, Inc.

Mountain West Research

1982 "Guide to Social Assessment." Report prepared for the Bureau of Land Management, U.S. Department of the Interior. Billings, MT.

1983 Decker Area Mines Comprehensive Social Science Study." Report prepared for the Office of Surface Mining, U.S. Department of the Interior, and the Montana Department of State Lands. Billings, MT.

Mulloy, William T.

1958 *A Preliminary Historical Outline for the Norhtwestern Plains.* University of Wyoming Publications in Science. New York: McGraw-Hill.

Myers, Paul; Davidson, Susan; and Trent, Joan

1983 Field interviews conducted in May 1983 in Broadus, Montana, by BLM employees.

References

Northern Cheyenne Tribe

1981 "Social and Economic Impact Study for the Montco EIS." Report prepared for the Montana Department of State Lands. Lame Deer, MT.

1983a "Responses to BLM Requests for Information for Second Powder River Sale EIS." A response to a request for information from the BLM, June 24, 1983.

1983b "Statement of the Northern Cheyenne Tribe: Powder River Basin Coal Region EIS Scoping Meeting." Statement submitted at scoping meeting at Ashland, Montana.

Pacifica Services, Inc.

1982 "Rocky Mountain Energy Development: Employment and Business Opportunities for Native Americans." Report prepared for the Office of Minority Economic Impact, U.S. Department of Energy. Los Angeles, CA.

Paul Nelson Associates, Inc.

1981 "Residential Subdivisions and Surface Mining: Comparative Analysis." Report prepared for the Texas Energy Services, Inc., of Gillette, Wyoming. Salt Lake City.

PEDCO Environmental, Inc.

1983 "Affected Environment Technical Report: Air Quality Report, '84 Coal Sale." Chapter 2 of a report prepared under contract to the Bureau of Land Management, Casper Wyoming. Golden, CO.

Rahn, P. H.

1976 *Potential of Coal Strip-mine Spoils as Aquifers for the Powder River Basin.* Engineering and Mining Experiment Station publication. Rapid City, SD: South Dakota School of Mines and Technology.

Rau, John G., and Wooten, David C., eds.

1980 *Environmental Impact Analysis Handbook.* New York: McGraw-Hill.

Reher, Charles A.

n.d. "The Western Powder River Basin Survey: Report of Survey Results." Report prepared for the Bureau of Land Management.

Ries, Ron

1982 "Warm Season Grasses for Revegetation in the Northern Great Plains." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Simon, Ruth B.

1972 "Seismicity." In *Geological Atlas of the Rocky Mountain Region,* p. 48ff. By Rocky Mountain Association of Geologists. Denver: Rocky Mountain Association of Geologists.

United States. Department of Agriculture. Forest Service

1974a *National Forest Landscape Management.* Vol. 2: *Chapter 1: The Visual Management System.* Agriculture Handbook Number 462. Stock No. 0101-00358. Washington: Government Printing Office.

1974b *Rehabilitation Potential and Limitations of Surface-Mined Land in the Northern Great Plains,* by Paul E. Packer. General Technical Report INT-14. Ogden, UT: Intermountain Forest and Range Experiment Station.

n.d. *Unsuitability Criteria Assessment: High-to-Moderate Coal Potential.* Laramie, WY.

United States. Department of Agriculture. Soil Conservation Service

1981 Personal communication regarding types of agricultural land in southeast Montana, with Clarke McClung of Casper District, Bureau of Land Management. Cited in USDI, BLM, *Final Powder River Regional Coal EIS,* 1981.

United States. Department of the Interior. Bureau of Land Management

1974 *Final Environmental Statement: Proposed Development of Coal Resources in the Eastern Powder River Basin of Wyoming.* 6 vols. [Cheyenne, WY.]

1979a *Final Environmental Statement: Federal Coal Management Program.* Washington: Government Printing Office.

1979b *Final Environmental Statement: Proposed Development of Coal Resources in Eastern Powder River, Wyoming.* Washington.

1980a *Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area.* Casper, WY.

1980b *Supplement to Wyoming Land Use Decisions: Determinations of Unsuitability for Coal Development: Highlight Review Area.* Casper, WY.

1980c *Visual Resources Management Program.* Stock no. 024-011-00116-6. Washington: Government Printing Office.

1981a *Coal Amendment to Wyoming Land Use Decisions: Western Powder River Basin Area.* Casper, WY.

1981b *Final Powder River Regional Coal Environmental Impact Statement.* Casper, WY.

1982 *Coal Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area: Recluse Review Area, Casper District.* Casper, WY.

1983 *Powder River Coal Region Tract Summaries.* [Cheyenne, WY.]

References

United States. Department of the Interior. Bureau of Land Management and Woodward-Clyde Consultants

1980 *Draft Environmental Impact Statement on the Energy Transportation Systems, Inc., Coal Slurry Pipeline Transportation Project.* Denver: Bureau of Land Management.

United States. Department of the Interior. Geological Survey.

1973 *Water Resources of the Powder River Basin and Adjacent Areas, Northeastern Wyoming,* by Warren G. Hodson, Richard H. Pearl, and Stanley A. Druse. Prepared in cooperation with the Wyoming State Engineer.

United States. Department of the Interior. Geological Survey; and Montana. Department of State Lands

1979 *Draft Environmental Statement: Regional Analysis: Northern Powder River Basin Coal, Montana.* N.p.

United States. Department of Transportation.

1980 *Preliminary Final Environmental Impact Statement: C&NW Coal Line Project.* N.p.

University of Wyoming. Agricultural Experiment Station

1977 *Wyoming General Soil Map.* Research Journal 117. Laramie, WY.

Van Voast, W. A., and Hedges, R. B.

1975 *Hydrologic Aspects of Existing and Proposed Strip Mines Near Decker, Southeastern Montana.* Bulletin 97, Montana Bureau of Mines and Geology. Butte, MT.

Wollenhaupt, Nyle C., and Richardson, Jim L.

1982 "The Role of Topography in Revegetation of Disturbed Lands." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Wyoming. Game and Fish Department

1979 "Final Report: Eastern Powder River Coal EIS Contract." Report prepared for the Bureau of Land Management, U.S. Department of the Interior, under contract YA-512-CT8-126. Cheyenne, WY.

Wyoming. Office of the Attorney General

var. *Crime in Wyoming.* Cheyenne, WY. Annual publication—editions of 1978, 1979, 1980, 1981, and 1982 were consulted.

Wyoming Crop and Livestock Reporting Service

1981 *Wyoming Agricultural Statistics 1981.* Cheyenne, WY: Wyoming Crop and Livestock Reporting Service. Issued cooperatively by Wyoming Department of Agriculture, the University of Wyoming, and the United States Department of Agriculture, Statistical Reporting Service.

ERRATA

On the Regional Activity map in the back of this document, the two PRLAs that have been identified as "Thundercloud I" and "Thundercloud II" should be Thunderbird I and Thunderbird II.

☆U.S. GOVERNMENT PRINTING OFFICE:1984—776-061 / 1042

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

Form 1279-3
(June 1984)

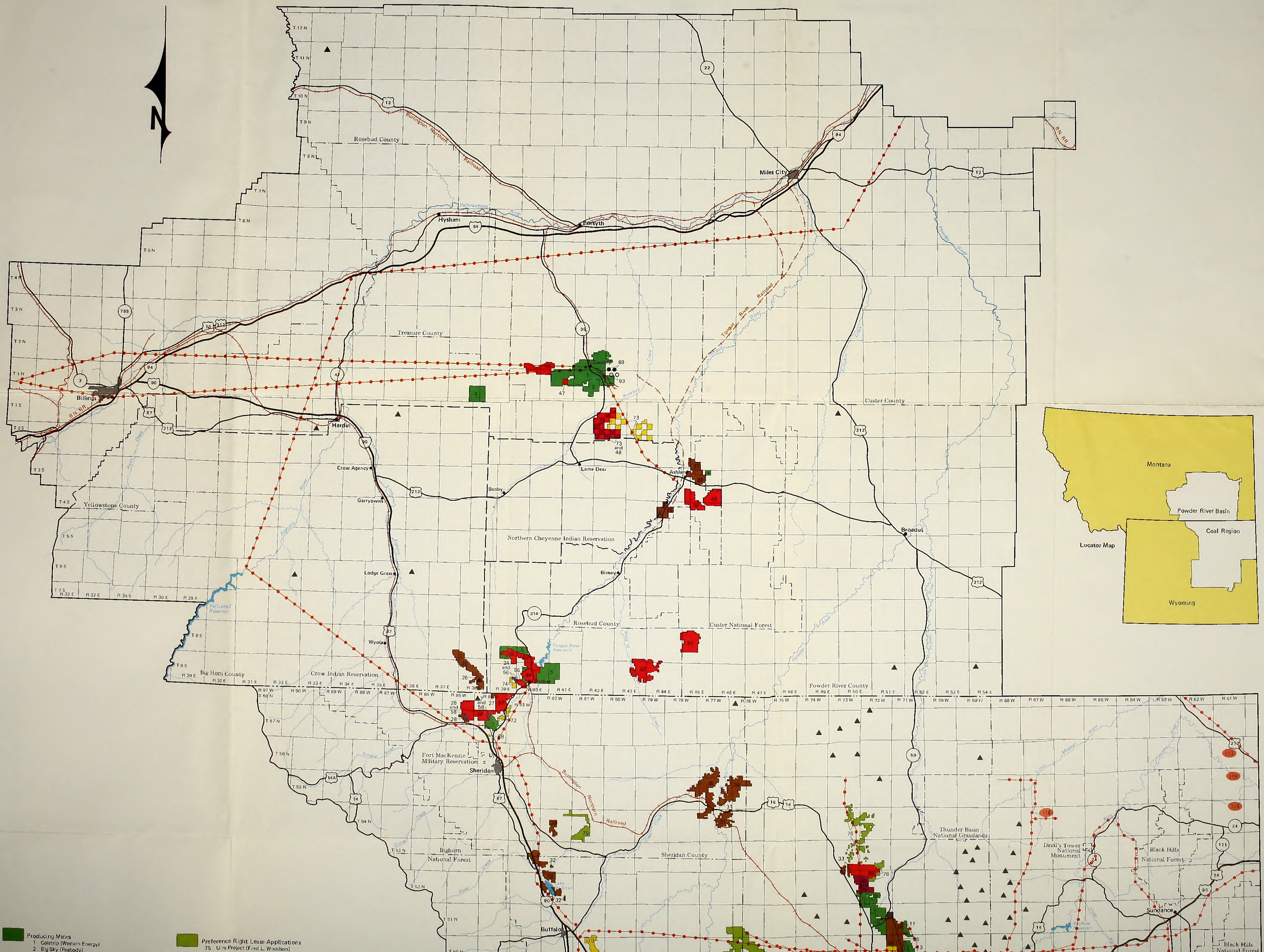
BORROWE

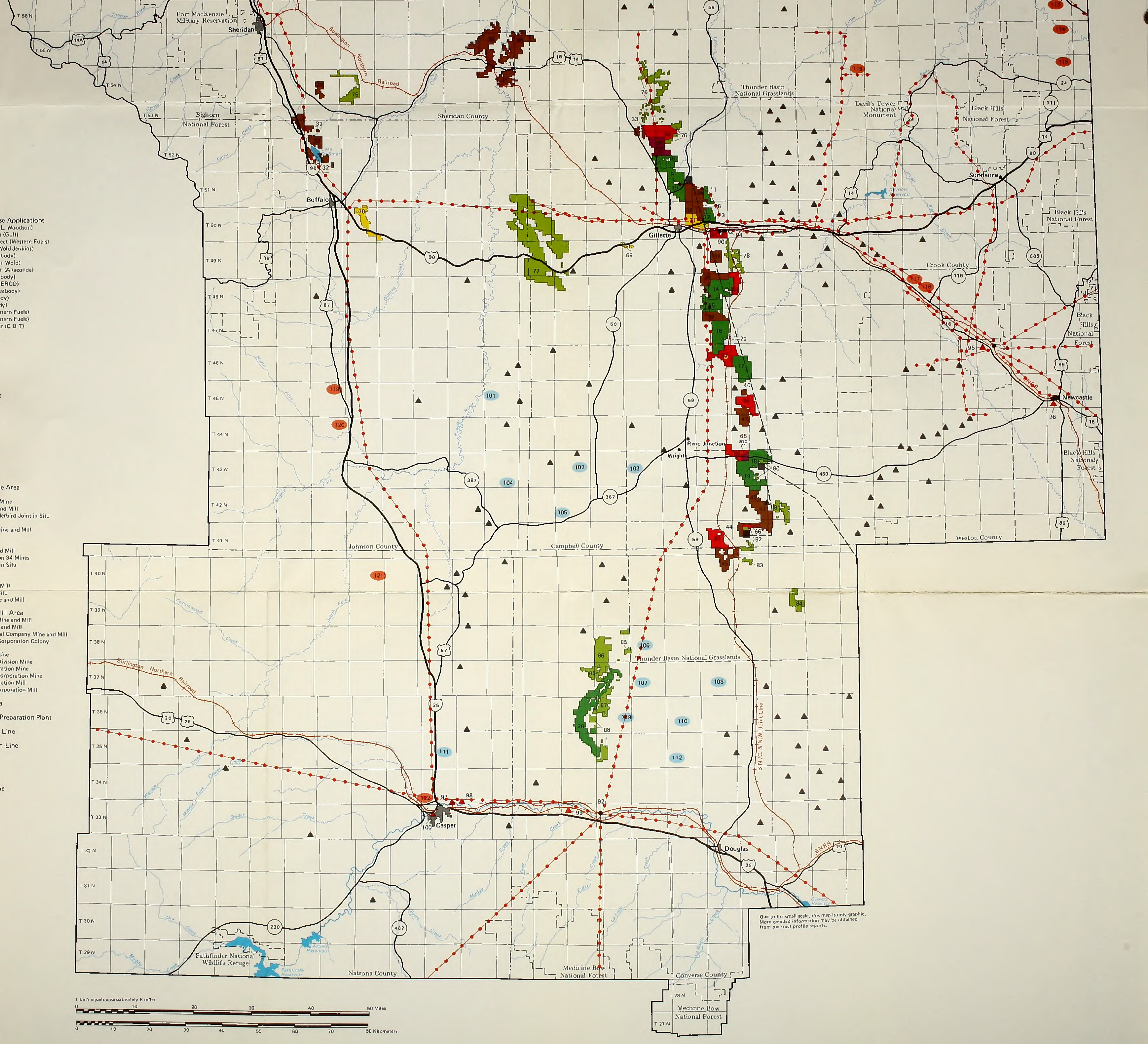
TD 195 .C58 F683 198
Draft environmental
statement for round

DATE LOANED	BORROWER

USDI - BLM

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225


N
Rosebud County
Treasure County
Custer County
Yellowstone County
Big Horn County
Powder River County
Sheridan County
Miles City
Forsyth
Hysham
Billings
Hardin
Colstrip
Crow Agency
Garryowen
Lodge Grass
Wyola
Busby
Lame Deer
Ashland
Birney
Broadus
Decker
Sheridan
Buffalo
Sundance
Northern Cheyenne Indian Reservation
Crow Indian Reservation
Custer National Forest
Fort MacKenzie Military Reservation
Bighorn National Forest
Thunder Basin National Grasslands
Devil's Tower National Monument
Black Hills National Forest
Yellowstone River
Powder River
Tongue River
Bighorn River
Tongue River Reservoir
Yellowtail Reservoir
Burlington Northern Railroad
Tongue River Railroad
BN RR
Locator Map
Montana
Powder River Basin
Coal Region
Wyoming
Producing Mines
1 Colstrip (Western Energy)
2 Big Sky (Peabody)
Preference Right Lease Applications
75 Ulm Project (Fred L. Woodson)



Due to the small scale, this map is only graphic. More detailed information may be obtained from the tract profile reports.

1 Inch equals approximately 8 miles.

0 10 20 30 40 50 Miles

0 10 20 30 40 50 60 70 80 Kilometers

🟩 Producing Mines
1 Colstrip (Western Energy)
2 Big Sky (Peabody)
3 Absoloka (Westmoreland)
4 Coal Creek (MT)
5 Spring Creek (NERCO)
6 Decker-East and West (Peter Kiewit)
7 Big Horn (Peter Kiewit)
8 Buckskin (Shell)
9 North Rawhide (Carter)
10 Eagle Butte (AMAX)
11 Fort Union (Delzer Construction)
12 Clovis Point (Kerr-McGee)
13 Wyodak (Wyodak)
14 Caballo (Carter)
15 Belle Ayre (AMAX)
16 Cordero (Cordero)
17 Coal Creek (WY)(Anaconda)
18 Jacobs Ranch (Kerr-McGee)
19 Black Thunder (Anaconda)
20 Dave Johnston (Glenrock Coal)

🟫 Nonproducing Mine
21 Cook Mountain (Thermal Energy)
22 Coal Creek (Wesco Resources)
23 Montco-Nance (Montco)
24 C X Ranch (Consolidation-Chevron)
25 Tanner Properties (Shell)
26 Crow-Shell (Shell)
27 Ash Creek (Ash Creek Mining)
28 Black Mountain (Black Mountain)
29 Dutchman (J M T)
30 Bass Properties (Bass)
31 Gulf Properties (Gulf)
32 Texaco Properties (Texaco)
33 Wildcat Creek (Gulf)
34 Dry Fork (Phillips)
35 South Rawhide (Carter)
36 East Gillette (Kerr-McGee)
37 Peabody (Peabody)
38 Rocky Butte (Texas Energy)
39 Caballo Rojo (Mobil)
40 Wymo Fuels (Wymo)
41 Keeline (Neil Butte)
42 North Rochelle (Shell)
43 Rochelle (Peabody)
44 North Antelope (North Antelope Coal)
45 Antelope (NERCO)

🟥 Selected Coal Tracts
46 Colstrip Area C (Maintenance)
47 Colstrip Maintenance
48 Downey Coulee
49 Ashland (Decker-Birney)
50 Northwest Otter Creek
51 Mud Springs
52 Hanging Woman Creek
53 North Decker I (Maintenance)
54 North Decker II (Maintenance)
55 Spring Creek (Maintenance)
56 Wolf Mountain (Maintenance)
57 Youngs Creek
58 Hidden Water
59 Calf Creek
60 Hay Creek
61 Donkey Creek (Maintenance)
62 Timber Creek
63 Mount Logan
64 Kintz Creek
65 Thundercloud
66 Porcupine (Maintenance)
67 Ridgerunner

▨ Conflict Area between Selected Coal Tracts and Coal Exchanges

🟦 Conflict Area between Selected Coal Tracts and Producing or Nonproducing Mines

🟨 Coal Exchanges
I–90 Exchanges
68 Big Horn
69 Gulf
70 Belco
71 Kerr-McGee

A V F Exchanges
72 Whitney Benefits

Northern Cheyenne Exchanges
73 Peabody Coal
74 Consol

🟩 Preference Right Lease Applications
75 Ulm Project (Fred L. Woodson)
76 Wildcat Creek Area (Gulf)
77 Thundercloud Project (Western Fuels)
Thundercloud II (Wold-Jenkins)
78 South Gillette (Peabody)
79 Belle Fourche (John Wold)
80 East Black Thunder (Anaconda)
81 Rochelle Area (Peabody)
82 North Antelope (NERCO)
83 South Antelope (Peabody)
84 Dull Center (Peabody)
85 Sand Draw (Peabody)
86 Stevens North (Western Fuels)
87 Stevens South (Western Fuels)
88 South Powder River (C D T)

● Existing Power Plant
89 Colstrip 1
Colstrip 2
90 Neil Simpson
Wyodak
91 Osage
92 Dave Johnston

○ Proposed Power Plant
93 Colstrip 3
Colstrip 4
94 Wyodak 2

▲ Refinery
95 Osage
96 Wyoming
97 Texaco
98 Little America
99 Glenrock
100 Amoco

● Uranium Mill and Mine Area
101 Irigaray in Situ
102 Greasewood Creek Mine
North Butte Mine and Mill
PINTEC and Thunderbird Joint in Situ
103 Reno Road in Situ
104 Charlie Ore Body Mine and Mill
105 Moore Ranch Mine
Sand Rock Mill
106 Bear Creek Mine and Mill
107 Open Pit and Section 34 Mines
108 Teton Exploration in Situ
109 Bill Smith Mine
SPRB Mill
110 Highland Mine and Mill
111 Nine Mile Lake in Situ
112 Morton Ranch Mine and Mill

● Bentonite Mine and Mill Area
113 American Colloid Mine and Mill
114 NL-Industries Mine and Mill
115 International Mineral Company Mine and Mill
116 Federal Bentonite Corporation Colony Mine and Mill
117 American Colloid Mine
118 Federal Bentonite Division Mine
119 Benton Clay Corporation Mine
120 Kaycee Bentonite Corporation Mine
121 Benton Clay Corporation Mill
122 Kaycee Benonite Corporation Mill

▲ Oil and Gas Field Area

■ Proposed Coal Slurry Preparation Plant

—●—●— Existing Transmission Line

-●- -●- Proposed Transmission Line

—+—+— Existing Railroad

-+- -+- Proposed Railroad

— — — Proposed ETSI Pipeline

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

1984 Coal Lease Sale Regional Activity
Powder River Coal
Environmental Impact Statement

☆ GPO 1983-776-424